Summer Training at
Aditya CARE Hospital (A Unit of M/s. Quality CARE India Ltd.)

- **Clinical Audit –Chest Pain Pathway Compliance with Patient Safety Check and Door to Balloon Time in a NABH Accredited Multispecialty Hospital**
- **Study of Modular Operation Theatre Complex in New Project of Care Hospital in Post Contraction Commissioning Phase**

By
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MBA Hospital and Health Management
2015-2017

The IIHMR University, Jaipur
2016

INSTITUTE OF HEALTH
MANAGEMENT RESEARCH
(WHO Collaborating Centre for District Health System Based on Primary Health Care)

IIHMR UNIVERSITY

CERTIFICATE

TO WHOMSOEVER MAY CONCERN

This is to certify that **Dr. Vandana Gupta**, student of **MBA in Hospital and Health Management** from The IIHMR University, Jaipur has undergone internship training from **Aditya CARE Hospital (A Unit of M/s. Quality CARE India Ltd.), Bhubaneswar** from **1st April 2016** to **1st June 2016.**

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish her all success in all her future endeavors.

Col(Dr) Ashok Kaushik
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Aditya CARE Hospital

(A Unit of Quality Care India Limited)
Bhubaneswar

CARE HOSPITALS

Letter No: ACH/CHA/4021/16-17

Date: 30.05.2016

CERTIFICATE

This is to certify that **Dr. Vandana Gupta** has completed Summer Training at **Aditya CARE Hospital,** Bhubaneswar from **April 1st to May 31st, 2016** from IIHMR, Jaipur. She completed her two projects on **"Study of Modular Operation Theatre Complex in New Project of CARE Hospital in Post Construction Commissioning Phase"** and **"Clinical audit- Chest pain pathway compliance with patient safety check and Door to Balloon time in a NABH Accredited Multispecialty Hospital".**

This is her bonafied work, carried out under my guidance & supervision. Dr. Vandana Gupta was very sincere and hard worker.

I wish her every success in her future career.

Dr. S.K. Mishra
Chief Hospital Administrator
Aditya CARE Hospital
Bhubaneswar - 16

Place: Bhubaneswar
Date: 30-05-2016

Dr.S.K.Mishra
Chief Hospital Administrator
Aditya CARE Hospitals
Bhubaneswar

CLINICAL AUDIT –CHEST PAIN PATHWAY COMPLIANCE WITH PATIENT SAFETY CHECK AND DOOR TO BALLOON TIME IN A NABH ACCREDITED MULTISPECIALTY HOSPITAL

ACKNOWLEDGEMENT

I extend my sincere gratitude to **Ms. SonaliSundaray (AGM Operations)**, who has been my mentor for the summer internship project & has been instrumental in helping me shape this study in a desirable way and for giving me the opportunity to do this study and undergo the process of learning at Aditya CARE hospital (A Unit of M/s. Quality CARE India Ltd.)

I thank her for all the trust and faith she posed in me and I only hope that I have been able to live up to her expectations. Her guidance and support was helpful in enhancing my work.

I am indebted to**Dr.Sanatosh Mishra**(Chief Hospital Administrator),**Mrs. RajshreeUpadhaya**(DGM HR)for entrusting me and giving me permission to go ahead with this project in. I would also like to thank **Mrs. Malavikatripathy** (Manager QualityDepartment),**Mr. Bindusagar**(assistant manager quality), and **Ms.Priyanka**(Quality coordinator)for supporting my work all along.

Last but not the least the entire staff of Aditya CARE Hospital for their support and guidance and cooperation.

I would like to express my sincere thanks to **Dr. S.D. Gupta(President, IIHMR University)**, **Col.** (**Dr.) Ashok Kaushik (Dean, Academics and Student Affairs)**, of IIHMR university for their proper guidance . I am also grateful to my parents, my family and my friends for giving me moral support.

Organization profile-

About CARE group-

The CARE Hospitals Group is a multispecialty healthcare provider, with 16 hospitals serving 8 cities across 6 states of India. The regional leader in tertiary care in South/Central India and among the top 4 pan-Indian hospital chains, CARE Hospitals delivers comprehensive care in more than 30 specialties in tertiary care settings.

Adopting a service-oriented delivery model, CARE Hospitals provides cost-effective medical care, with an uncompromising commitment to its core purpose, "To provide care that people trust." Founded in 1997 by Dr B Soma Raju and a team of India's leading cardiologists, the CARE Hospitals' founders developed Asia's first indigenous coronary stent — the 'Kalam-Raju stent,' named after Dr APJ Abdul Kalam, former President of India, and Dr B Soma Raju, Chairman and Managing Director, CARE Hospitals Group. This is just one of the many innovations developed at CARE Hospitals, which strives to make healthcare affordable for all, while ensuring clinical outcomes at par with international standards.

The CARE team has many firsts to its credit:

- 1st Prospective randomised trial of balloon valvotomyvs mitral valve replacement in the world
- 1st Coronary Angioplasty in India
- 2nd Balloon Valvuloplasty in India
- 1st Cardiac MRI in India

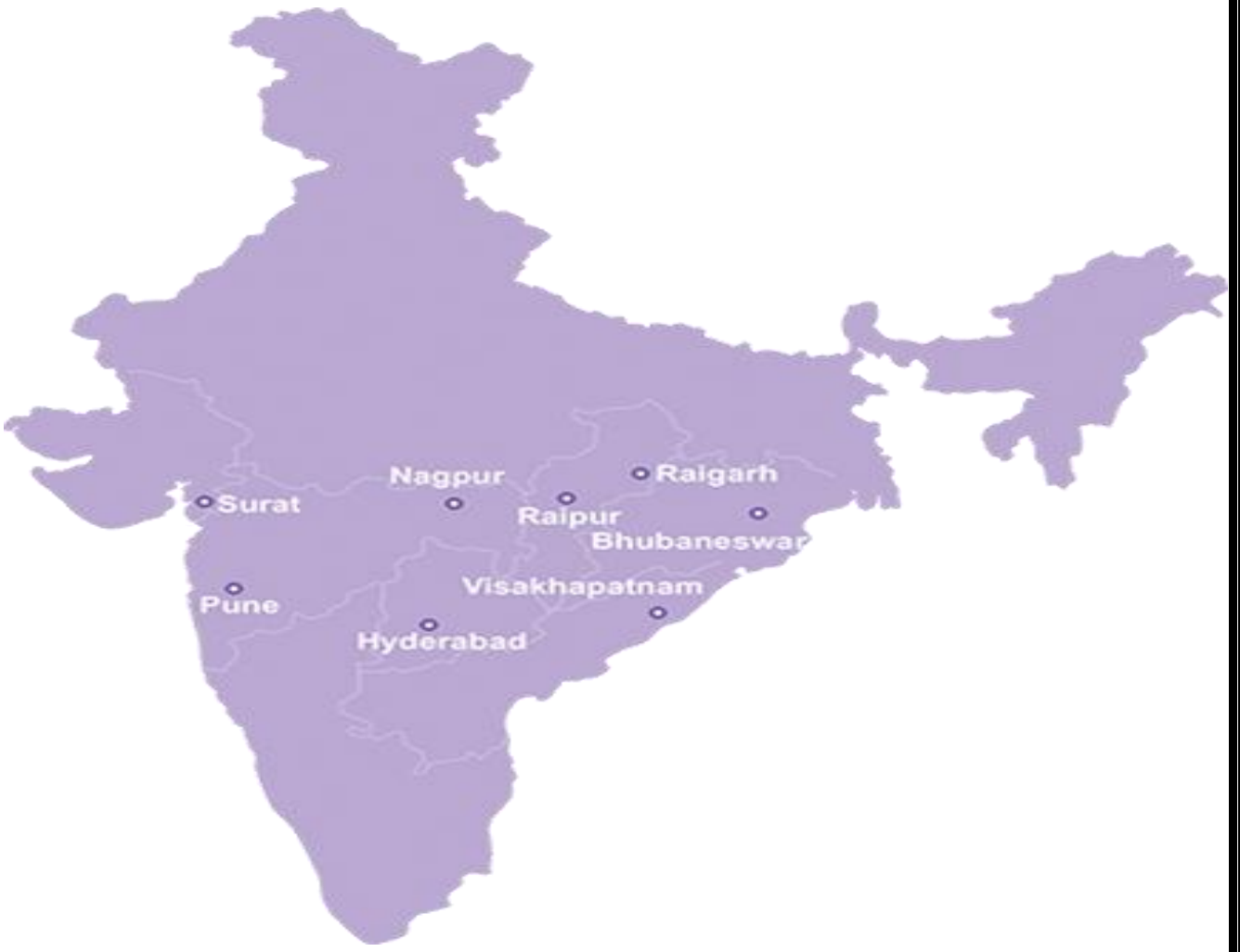
- 1st Atrial Fibrillation Clinic in India
- 1st Beating Heart Surgery in Andhra Pradesh
- 1st Heart Transplant Performed in a tier-2 town (Visakhapatnam)

Today the CARE Hospitals Group comprises 18 multi super specialty hospitals offering comprehensive patient-focused care, with 24*7 state-of-the-art infrastructure, medical equipment and facilities, complemented by globally trained and experienced doctors and professional support staff. It is recognized as the most advanced, complete cardiac care centre in the country, powered by cross-functional teams with deeper skill sets and round-the-clock availability of cardiologists, cardiac surgeons, critical care and emergency medicine specialists. The hospitals are models for high doctor-patient and nurse-patient ratios to ensure patient satisfaction.

CARE Hospitals is a complete healthcare ecosystem, with related components of education/training and research, pursuing innovations that make healthcare more affordable. A network of telemedicine hubs in rural Andhra Pradesh and Maharashtra deliver care at the doorstep to lakhs of people. These activities are managed by its partner CARE Foundation.

CARE Hospitals continually updates medical knowledge and puts it into practice — taking innovations from the bench to the bedside. The Group has a rigorous Clinical Research programme (certified by the Drugs Controller General of India), with advanced infrastructure and trained resources to conduct clinical trials in the areas of drug and medical device development. Both pioneering original research and sponsored clinical trials are conducted at several hospitals and over 40 studies are under way, at any given time.

CARE Hospitals is owned and managed by Quality CARE India Ltd.



Hospital chain-

1.)Hyderabad(Banjara hills)

2.)Hyderabad-outpatient (Banjara hills)

3.) Hyderabad (Nampally)

4.) Hyderabad(Hi-tech city)

5.)Vishakhapatnam(Ramnagar)

6.) Vishakhapatnam(Maharani peta)

7.) Vishakhapatnam(railway new colony)

8.)Raipur(Dhamtari road)

9.) Raipur(GE road)

10.)Bhubaneswar

11.)Bhubaneswar(New)

12.)Nagpur

13.)Surat

14.) Pune

15.)Raipur

16.)Jabalpur

17.)Hyderabad(secunderabad)

18.)Hyderabad(musheerabad)

Aditya CARE hospital Bhubaneswar

CARE Hospitals, Bhubaneswar, was inaugurated on 24th September 2007; full-fledged services started from October 2007 onwards. The 98-bed largest, private, multi-super speciality corporate hospital in the city, it has experienced doctors, well-trained paramedical professionals and state-of-the-art equipment. CARE Hospitals has incorporated the latest techniques in patient care to stay abreast of the changing scenario in medical science, while providing quality health care at an affordable price. The CARE Hospitals Group has been the leader in heart care. But while cardiology and cardiothoracic surgery have been the uncontested domain of the CARE Group, they have also emerged as the preferred multi-super speciality destination for patients from all over India.

The hospital is driven by the commitment to provide high-quality, effective and cost-efficient health care to the people of Odisha. At CARE Hospitals, the best of care is delivered with compassion by using emerging healthcare technologies and continuous quality improvement.

Inculcation of qualities such as perceptive listening and careful observation among our personnel and a pledge to put the patients' interests above our own are the hallmarks of our service. This commitment is assimilated into our dynamic work force and their passion to gain the patient's trust is reflected in the goodwill the hospital has garnered for itself.

Infrastructure

CARE Hospitals has emerged as a trusted name in healthcare delivery, offering state-of-the-art facilities and care by renowned consultants.

Intensive Care Unit

The Intensive Care Units are customized to effectively manage a range of specialised problems. The Critical Intensive Care Unit (CICU) is equipped with computerized bedside monitoring facility. Cardiac surgery and cardiology patients are provided with specialized beds in post-operative units.

The state-of-the-art Intensive Care Unit has:

- Cardiac defibrillators
- Advanced ventilators
- Infusion pumps
- Transvenous& transthoracic pacing
- Pulse oximetres
- Continuous oxygen supply
- Invasive and non-invasive pre-monitoring system
- Temporary pacemaker
- Nebuliser and blood gas analyzer
- 24-hour cardiologist
- 24-hour anesthetist
- Specially trained medical and paramedical staff

Catheterization lab

The Cardiac Catheterisation Lab at CARE Hospitals enables highly qualified interventional cardiologists to perform complex cardiac procedures effectively, with pinpoint accuracy and the minimum amount of radiation. The hospital also has an active Paediatric Cardiac Intervention facility.

The Cardiac Surgery Services offer treatment for all types of surgically repairable heart diseases — from coronary bypass surgery in the elderly to congenital heart diseases in infants and children (1 to 2 weeks old – 18 years of age). The cardiothoracic team also performs cardiac transplantations and is a leader in cardiac surgery, with an enviable success rate of over 99%.

Dialysis

The Department of Nephrology, in association with the Department of Urology, has given new hope to patients suffering from renal failure. The department is staffed by highly professional nephrologists and trained dialysis technicians and nurses, capable of taking complete care of routine and emergency patients. In addition to routine haemodialysis and peritoneal dialysis, Continuous Ambulatory Peritoneal Dialysis (CAPD) is also offered to patients.

Other Facilities

- Admission, on the day of arrival, is assured on priority for outstation patients.
- One attendant is provided accommodation, free of cost, with the patient in the hospital wards.
- An in-house Food and Beverage Department, with a cafeteria, caters to the requirements of patients and their family members.
- On prior intimation, patients can be picked up from the railway station or airport.

Blood Bank

The Blood Bank has been outsourced. We collaborate with the following blood banks:

- Red Cross Blood Bank Bhubaneswar
- Kalinga Hospital Blood Bank, Bhubaneswar
- IMS & Sum Hospital Blood Bank, Bhubaneswar

Ambulance

Ambulance services are available for emergency cases, 24 hours, with hi-tech cardiac facilities.

Emergency Room

The Emergency Room is equipped with the best facilities. It has five beds in the Casualty room, which generally treats cardiac cases. The room has been designed to

have a close semblance to an ICCU for the patients' requirements. Emergency Services are available 24 hours a day.

- 30 Critical Care beds/ICCU beds
- AMCU – 8 beds
- SICU – 8 beds
- CTICU – 5 beds
- ICCU – 9 beds

Facilities

- Anaesthesiology
- Cardiac Sciences
- Critical Care
- Dermatology
- Dietetics & Nutrition
- Emergency Medicine
- ENT

- Gastroenterology
- General Medicine
- General Surgery & Surgical Gastroenterology
- Laboratory Medicine
- Nephrology
- Neuro Sciences
- Orthopaedics

- Physiotherapy & Rehabilitation
- Pulmonology
- Radiology

Clinical Services

- Anaesthesiology
- Cardiology
- Cardiothoracic Surgery

- Critical Care
- Dermatology (OP)
- Dialysis
- Diabetology
- Emergency Medicine
- General Medicine
- General Surgery
- Medical Gastroenterology (On call)
- Nephrology
- Neurology
- Orthopaedics Surgery
- Otorhinolaryngology (ENT)
- Respiratory Medicine
- Psychiatry (Cross consultation only)
- Plastic and Reconstruction Surgery
- Surgical Gastroenterology (Laparoscopic)
- Urology

Departments-

Building 1 (ground floor)

1.Emergency room

2.Ambulance service

3.Information desk

4.Reception and front office

5.Reception for corporate patient

6.24 Hours OP Pharmacy

7. Hospital administrator office

8.OP Rooms

9.CATH Lab

10.General Ward G

11. General Ward D

12.Dietics

14. IP Pharmacy

15.Physiotherapy department

16.Pulmonary room

16. Sample collection room

17. Counselling room

18.Corporate and insurance department

19.AGM Hospital operation office

20.Biomedical engineering department

21.Maintenance department

22.OT Pharmacy

23.Radiology(X-ray,ultrasound)

24.TMT and ECG room

25.ECHO Room

FRIST FLOOR

1.General ward 121

2.General ward 123

3.Post op wards

3.Private cabin

4.Nursing station

5.General OT

6.Housekeeping department

7.Communication centre

8.Executive desk

9.Dilysis

10.Nephrology department

11. Endoscopy Room

SECOND FLOOR

1.ICCU

2.AMCU

3.CTICU

4.Step down ICU

5.CT OT

6.General ward

THIRD FLOOR

1. CSSD
2. Laboratory
3. Quality assurance department
4. Billing department
5. Dining hall

ANNEXURE BUILDINGS

1. Conference hall
2. HR Department
3. Board meeting room
4. CT
5. Medical record department
6. Finance department
7. Marketing and business development department
8. Security office
9. Cafeteria and canteen

- The hospital is well known for interventional cardiology and well equipped with latest technology and required manpower.

There are

- 24 consultants on regular basis
- 9 part-time
- 11 visiting
- 9 resident doctors
- 4 resident trainee doctors
- 140 nursing staff
- 12 nursing trainees
- 4 nursing internees

Purpose/vision/values of organization

-Purpose- To provide care that people trust.

-Vision- To be trusted, people centric, integrated healthcare system as a model for global health.

-Values

Honesty and integrity

The practice of honesty fortifies character. Integrity means doing right at all times and willingness to live by the standards and beliefs of the organization.

Team work

A collaborative work ecosystem.Where the collective efficiencies are harnessed for delivering the best possible care.

Empathy and compassion

The ability to understand the feelings of patients as well as employees.so that the services delivered are humane and in a supportive work environments.

Education

Continuous learning for the creation of a sustainable healthcare system, where employees and the organization can grow together.

Citizenship

Good governance and appropriate working relationship with all stakeholders.

Based on compliance to laws and ethical practice.

Equity

Mutual trust based on fair and impartial consideration of all professional matters so that it fosters positive contributions towards the institutional purpose.

Dignity and respect

Treat all with utmost regard and esteem so that it enhance respect and ,in turn a sense of belonging.

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1.Clinical audit –Chest Pain Pathway compliance with patient safety check and Door to balloon time in a NABH accredited multispecialty hospital

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Abbreviations-

STEMI-ST elevation myocardial infarction

NSTEMI-Non ST elevation myocardial infarction

CAG-coronary angiography

UA-unstable angina

CABG-coronary artery bypass grafting

PTCA-percutaneous transluminal coronary angioplasty

ECG- electro cardiography

ECHO- echo cardiography

DMO-duty medical officer

ERP-emergency physician

PCI-Percutaneous coronary intervention

HTN- hypertension

DM-diabetes mellitus

AMCU-Acute multicare unit

ICU-intensive care unit

SICU-surgical intensive care unit

ERP DP-emergency physician data point

OS-order set

NICE-National institute for health and care excellence

AHA-American heart institution

1.Clinical audit –Chest Pain Pathway compliance with patient safety check and Door to balloon time in a NABH accredited multispecialty hospital

1.1 Introduction

1.1.1 Background of clinical audit

Clinical audit is a quality improvement process that seeks to improve patient care and outcomes through systemic review of care against explicit criteria and the implementation of change. Aspects of the structure, processes, and outcome of care are selected and systematically evaluated against explicit criteria. where indicated ,changes are implemented at an individual ,team, or service level and further monitoring is used to confirm improvement in healthcare delivery.(NICE)

The aim of clinical audit is to measure the gap between ideal practice(determined from evidence and guidelines) and actual practice. Audit dose not seek to apportion blame on individual practitioners, but aims to improve the system in which individual work. done correctly, audit can bring about change and improve practice and clinical effectiveness.

1. Clinical audit is not just a data collection exercise-

- ✓ It involves measuring current patient care and outcomes against explicit audit criteria (also termed standards)
- ✓ There is an expectation from the outset that practice will be improved.

1.1.2 Advantage of clinical audit

The overarching aim of clinical audit is to improve service user outcomes by improving professional practice and the general quality of service delivered.

For healthcare professional

- ✓ Provides workable standards
- ✓ Resolves problems
- ✓ Improves and increase team-working and levels of communication
- ✓ Ensure appropriate use of skills and resources
- ✓ Can identify training needs
- ✓ Measure quality in current practice

For patients

- ✓ Improved quality of care and service received
- ✓ Prompt changes in delivery of care
- ✓ Highlights precise patient needs

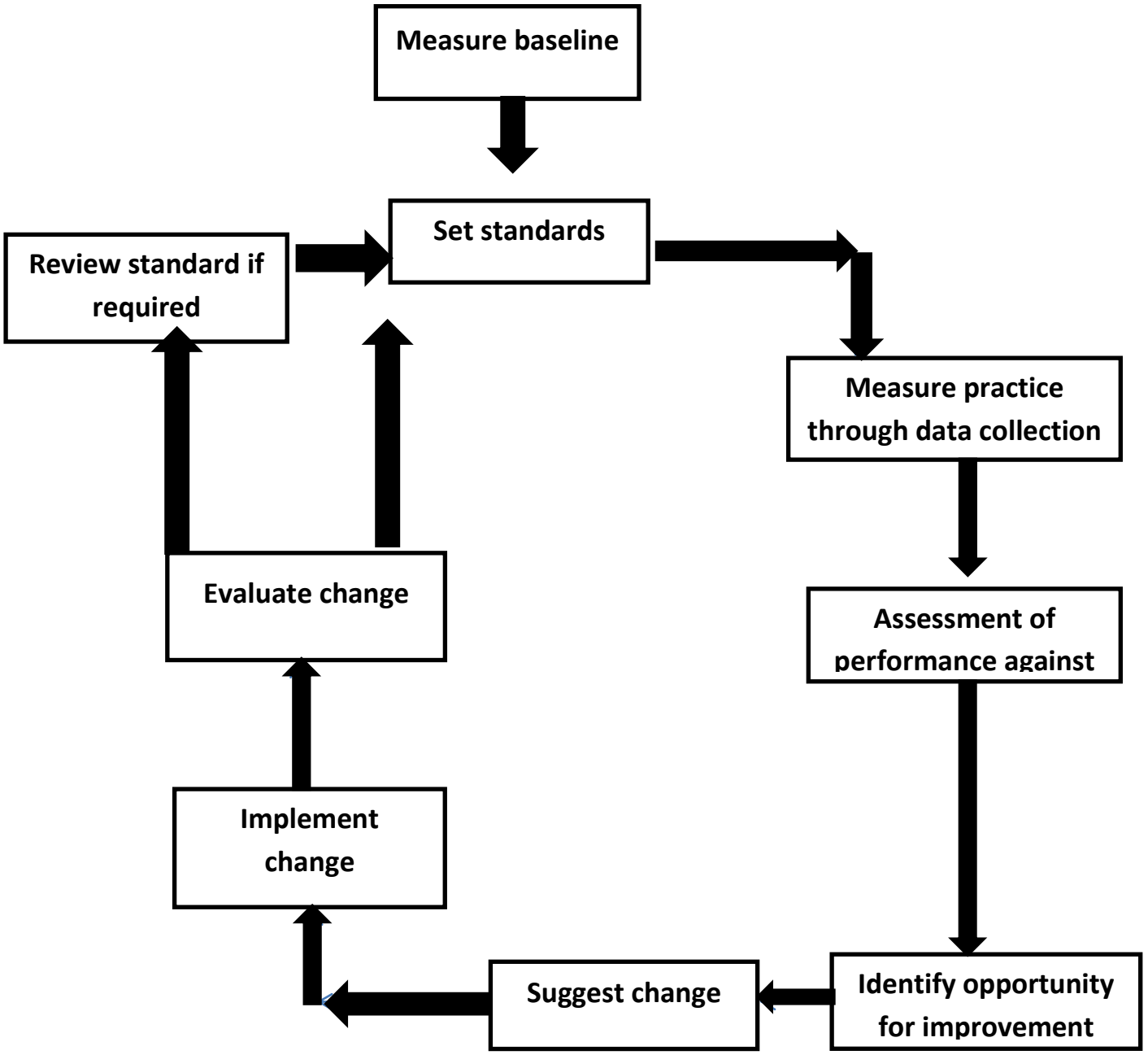
For organization

- ✓ Improved care of patients.
- ✓ Enhanced professionalism of staff
- ✓ Efficient use of resources.
- ✓ Aids in continuing education
- ✓ Aids in administration

Chest pain pathway is one of the critical path methods designed for cardiac patients management. The critical path method (CPM) is a step-by-step technique for process planning that defines critical and non-critical tasks with the goal of preventing time-frame problems and process bottlenecks. (*National Accreditation Board for Hospitals and Healthcare Providers)* The CPM is ideally suited to projects consisting of numerous activities that interact in a complex manner. In applying the CPM, there are several steps that can be summarized as follows:

- Define the required tasks and put them down in an ordered (sequenced) list.
- Create a flowchart or other diagram showing each task in relation to the others.
- Identify the critical and non-critical relationships (paths) among tasks.
- Determine the expected completion or execution time for each task.
- Locate or devise alternatives (backups) for the most critical paths.

The audit cycle



2 Aims and objectives of study-

2.1 Aim

The main aim of the study is to assess all the lifesaving support to cardiac patients with in time for proper management and to avoid the patient negligence.

2.2 objectives

To find out the compliance of chest pain pathway and to compare it with the set standards and criteria.

To compare it with the previous month data to know the effectiveness of the awareness and training programmes arranged for doctors and nursing staff for better compliance.

3 REVIEW OF LITERATURE-

Chest Pain audit in Tauranga, New Zealand

Presented by-Andrew R Chapmana, c, Stephen J Lesliea, Derek K Sageb

3.1Abstract

Background: Protocol based care is known to improve the outcomes

of patients admitted with recent onset chest pain. The aim of this clinical review was to investigate chest pain management,using newly published guidance from NICE, in the emergency department of a regional hospital in New Zealand.

Methods: All admissions with chest pain during the period of September-

October 2010 were identified retrospectively (n = 599), and sufficiently

Results: One hundred and eighteen patients were analysed (M =65, F = 53), 99.2% received an ECG on admission, yet only 59.3% of patients had documented evidence of a repeat ECG, with admissions during the day less likely to receive one compared to those admitted overnight (51.5% vs 69.2%, P = 0.04). Younger patients (<39 years) appeared less likely to receive aspirin than older patients(38.9% vs 80.0%, P = 0.06), 21.3% of patients failed to receive 300mg aspirin, and 45.6% of patients received oxygen despite normal saturations.

Conclusions: Despite good performance in a number of areas, this clinical review has highlighted that some standards, such as repeat ECGs, administration of aspirin therapy and appropriate use of oxygen are not being met in all patients with chest pain. A chest pain management pathway is to be implemented for all relevant

admissions, to ensure that essential aspects of care are not missed.

Timely dissemination and implementation of new clinical guidelines remains a chall

-enge in clinical practice

3.2 Introduction

Chest pain is a common and often non-specific symptom that can be caused by a number of underlying conditions, one of the most serious being acute myocardial infarction. Whilst only around a third of these presentations are cardiac in origin the potential severity of myocardial ischemia necessitates rapid assessment and management. In New Zealand, cardiovascular disease is the leading cause of mortality, with coronary artery disease responsible for 23% of all deaths in 1999. Over 52% of these deaths were due to myocardial infarction . Whilst rates of coronary artery disease are thought to be in decline, research has shown that Maori individuals.

are more likely to die from a myocardial infarction than age stratified European counterparts, with men and women at a 1.6 and 4.2 times increased risk, respectively Furthermore, mortality associated with coronary artery disease in Maori's under the age of 65 is almost three times that found in Europeans of a similar age . Cardiovascular disease is therefore a major public health concern in NewZealand, and campaigns to reduce the impact of modifiable risk factors such as smoking are widespread. The National Institute for Health and Clinical Excellence.

(NICE) is an independent UK organisation which provides national guidance on promoting health and preventing and treating poor health. They published updated guidelines for the management of recent onset chest pain in March 2010

Manuscript accepted for publication December 12, 2011a Highland Heartbeat Centre, Raigmore Hospital, Inverness.

3.3 Setting

Tauranga Hospital has one of the largest emergency departments in New Zealand, treating 45000 patients each year, including around 4000 presentations with chest pain.

Patient selection

All admissions to the emergency department of Tauranga Hospital between 01/09/10 and 31/10/10 were screened for the presenting complaint of 'chest pain using the medical records database. Patients were included if they had either on going chest pain, or recent chest pain (< 12 hours) which was now resolved. Those under the age of 18 were excluded,as were presentations which were known to be non-cardiac at an early stage and therefore not managed on an appropriate pathway for audit.

3.4 Sample size

This search generated records of 599 patients that fitted the inclusion criteria. After the population was identified, a sample size calculation was performed. As this audit is based on standards of 100%, the likelihood of a positive response formeasured criteria is high, therefore a response distribution of 90% was chosen. To detect a statistical effect with a confidence level of 95%, and 5% margin of error, the minimumsample size required is 113. Using the statistical package for social sciences (SPSS) version 18.1, a simple randomisation

3.5 Summary of NICE Guidance regarding management of acute chest pain presentations

Take a resting 12-lead ECG as soon as possible. When a patient is referred, send the results prior to arrival provided this doesnot delay transfer. Do not exclude an acute coronary syndrome (ACS) when patients have a normal resting 12-lead ECG.Do not routinely administer oxygen. Monitor oxygen saturation using pulse oximetry as soon as possible, ideally pre-admission.

Only offer supplementary oxygen to:

-People with SpO2 <94% who are not at risk of hypercapnic respiratory failure, with a target SpO2 of94-98%

-People with chronic obstructive pulmonary disease who are at risk of hypercapnic respiratory

Failure, with a target SpO2 of 88-92%, until blood gas available.

Scheme was employed, and 120 patients were identified.

3.6 Data handling and statistical analysis

Data was obtained from patient notes by the principal researcher and collected using an audit Performa consisting of 32 different variables (Appendix 1). Results were then Compiled in a spread sheet. Data was handled using SPSS,and assessed for normality. Appropriate statistical tests were employed as detailed in the results section. The level of statistical significance was deemed ($P < 0.05$) for all calculations.

3.7 Confidentiality

All patients were allocated a number, and data was recorded anonymously to ensure confidentiality was maintained. This research was exempt from formal ethical committee procedure, however, it was approved by the Research Manager of the Bay of Plenty District Health Board.

3.8 Results

From the original population of 599, 120 patients were identified

Two cases identified by the randomisation scheme were not eligible for inclusion as their presentations were not considered to be cardiac in origin at time of admission, leaving a total number of 118 eligible cases (53 females and 65 males).

Ages of those in the sample were found to be normally distributed. Women were older than men (64.9 ± 18.5 vs 61.6± 17.2, P = 0.24).

Time of admission was investigated as a potential influencing factor on the management of patients with chest pain.

As hospitals have fewer staff at night, it was hypothesised that those admitted outside of normal working hours (17:30 -08:00) would wait longer for clinical management and investigation. Further investigations sought to establish the effect of patient age on management decisions.

3.9 Discussion

This clinical review has identified several areas for discussion. Compliance with recent NICE standards was noted in establishing pain status and pain characteristics, eliciting previous episodes of chest pain, recording blood pressure, and completing a detailed physical examination. Furthermore,99.2% of patients received an ECG during their presentation to the emergency department. It is likely that these measures would identify the vast majority of patients presenting with an acute coronary syndrome.

However, some areas for improvement were identified. Risk factor documentation was incomplete in a proportion of patients and a repeat ECG was frequently not undertaken.

Aspirin was generally under prescribed and oxygen therapywas given outwith the recent guidelines. Trends involving time of admission, patient age and management decisions were also identified, and may require further exploration.

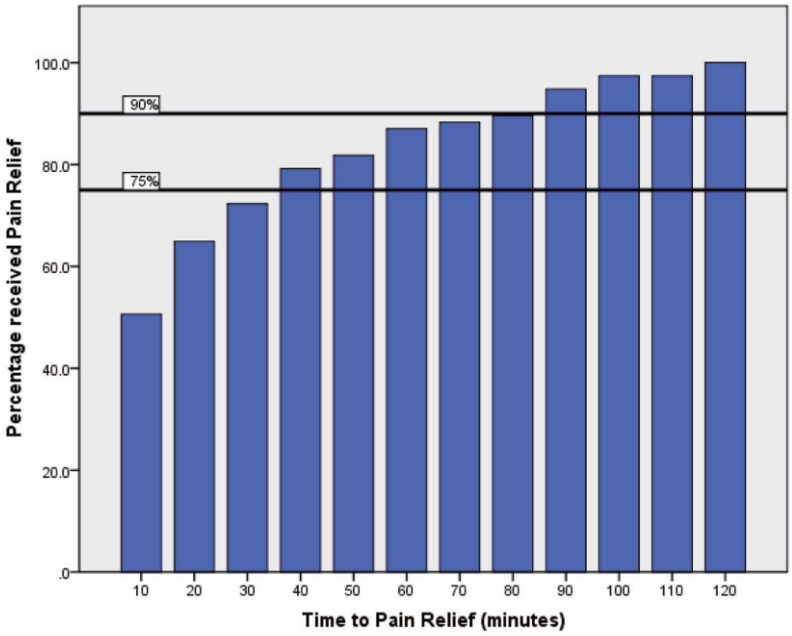


Figure3. 1. This bar graph highlights the time to initial ECG within the emergency department, versus the total number of completed ECGs. The College of Emergency medicine target of 90% ECG completion within 10 minutes is shown in black.

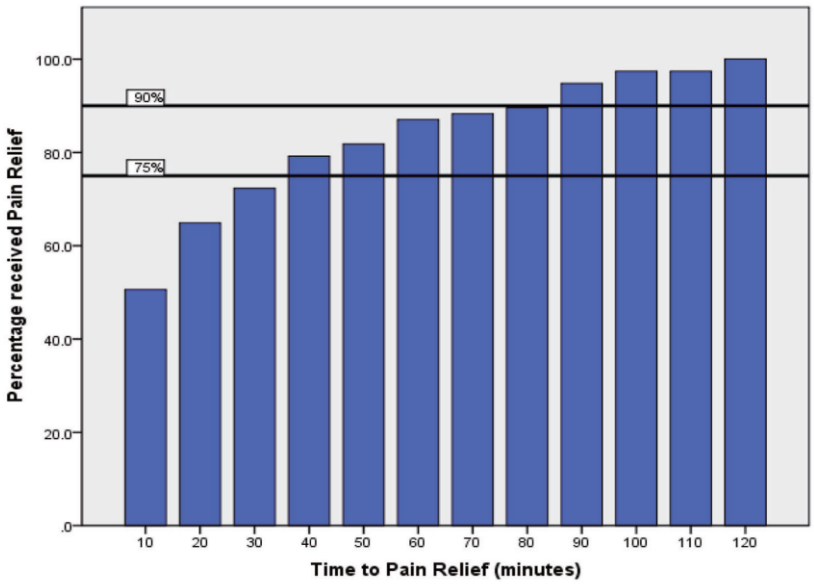


Figure3. 2. This bar graph depicts time to administration of pain relief after admission, versus the total percentage of patients requiring pain relief. The College of Emergency medicine targets of 75% pain relief within 30 minutes, and 90% within an hour, are shown in black.

4 Methodology

4.1 Study area-Aditya CARE hospital, Bhubaneswar

4.2 Study design-Cross sectional- quantitativeanalytical study

4.3 Approach- the approach of this project was-

- Used the predesigned tool and checklist of chest pain pathway.
- Self-observation of patients in emergency department.
- Review of the patient files and documents.

4.4 patient inclusion criteria

1. Patients admitted with complains of (cardiac symptoms) acute condition of chest pain which may radiate up to back, shoulder, arm, throat and jaw may be associated with anxiety/palpitation/chocking or squeezing sensation/nausea/vomiting symptoms which indicates the Myocardial infraction or angina.

2. And patients which are shifted from other canters where they were admitted with the similar complains or they had received the treatment for the same.

4.51. Primary source of data

- Self-observation in Emergency, ICCU,AMCU departments.
- Unstructured interview of nursing staff and doctors.

4.6. Secondary source of data

- Emergency department records.
- Patient files study
- Discharge files from medical record department.

4.7Study population and sample size

Convenient sampling has been done –Daily two patients studied in Emergency department between 9 AM to 6 PM.total 60 patients has been studied in April month.

4.8Standards and criteria set for the cardiac patients according ACC/AHA guidelines.

All facilities with Emergency Departments must have and use apathway that meets the following minimum standards for chest painpatients:

- Assigns triage category
- Critical times are documented (symptom onset, presentation)
- ECGs are taken and and interpretation within 10 min.
- Vital signs taken within 10 min.
- General management on arrival to be completed within 15 minutes
- 2 D echo screening should done within 20 minutes.
- Set drug order accordingly for STEMI/NSTEMI/UA (other than set orders if patient is not eligible)
- Investigation order set.
- Includes risk stratification by specialist within 30 minutes of arrival.
- Troponin levels are taken and reviewed.
- Aspirin is given, unless contraindicated
- A Senior Medical Officer is assigned to provide advice and support on chest pain assessment and initial management, 24/7
- A Nominated Cardiologist is assigned to provide advice on further Management 24/7
- For primary case (Primary PCI) mention door to balloon time within 90 minutes (in primary PCI set up)

4.9 format of chest pain pathway-

CARE HOSPITALS

CHEST PAIN PATHWAY

Patient details	Allergies

EMERGENCY DEPARTMENT RECORD

DATE		MR No.		IP No.	
TIME OF ARRIVAL		Date	MR No	IP No	
NAME				AGE	SEX
MOA	☐AMBULANCE ☐PRIVATE VEHICLE ☐PUBLIC TRANSPORT ☐WALK IN ☐OTH			PRE ARRIVAL NOTIFICATION: Y / N	
REF FROM (Hospital)	REF. DOCTOR :	LOS in prev hospital		TIME INFORMED	
PREVIOUS ENCOUNTER IN ER ☐<72 HRS ☐>72 HRS	PREV IP No._____	SAME COMPLAINT: Y/N			
INFORMANT: ☐ ATTENDANT ☐ BYSTANDER ☐POLICE ☐ REF. DOC ☐SELF ☐PARAMEDIC ☐OTHER					
ADMITTING DEPT		ADMITTING DOC			
CONDITION AT ARRIVAL	Active	Res Verbal commands	Res - to pain	Unconscious	

TRIAGE: **Triage Time:**

TRIAGE PRIORITY	RESUSCITATIVE	EMERGENT	URGENT	LESS URGENT	NON URGENT
	1 (USE CPR SHEET)	2	3	4	5

COMPLAINTS : PAIN	DURATION:	TYPE:	VITALS	TIME	TIME
SITE OF ONSET:	ONSET DURING:		BP		
QUALITY OF PAIN :	AGGREVATING FACTORS		HR		
SEVERITY	RELIEVING FACTORs:		RR		
RADIATION:			SPO2		
Additional notes of ER physician			TEMP		
			GCS		
			PAINSCORE		

DMO Notes : (Please fill the details not covered by ER physician to avoid duplication)

✓	Associated Symptoms	Description
☐	Nausea / vomitting	
☐	Shortness of breath	
☐	Coughing blood	
☐	Sweating	
☐	syncope	
☐	Palpitations	
☐	Feeling of doom	

✓	**Surgeries /Procedure done ☐None**
☐	Cardiac Bypass
☐	Cardiac cath / Stent
☐	Angioplasty
☐	Pace maker
☐	Stress test
☐	
☐	

☐	Hypertenstion	☐	Angina /Heart Failure
☐	Diabetes TYPE 1 TYPE 2	☐	DVT / PE RISK FACTORS
☐	Stroke	☐	Recent Surgery
☐	Gastritis	☐	Leg Swelling
☐	Peptic Uncer	☐	Bed Ridden
☐	Gall stones	☐	Paralysis
☐	High lipids		
☐	Heart Disease		

Other history details

MEDICATION RECONCILIATION (Current medications)			
Name of the drug	**Dose**	**Route**	**Duration**

LAST MEAL TAKEN AT:

PAIN SCORE (VISUAL SCORING)

ABC REVIEW (ASSESSMENTS AND INTERVENTIONS) ☐ **NOT EXAMINED** ☐ **NOT APPLICABLE**

AIRWAY :

☐ PATENT ☐ OROPHARYNGEAL ☐ NASO PHARNGEAL ☐ ENDO TRACHEAL

BREATHING AND VENTILLATION

☐ DYSPNOEA ☐ RESPIRATORY DYSFUNCTION		O2 _____LTRS	TIME:
☐ PULMONARY ODEMA ☐ ASTHMA ☐ TENSION PNEUMOTHORAX ☐ ASPIRATION			

CIRCULATION

DISABILITY

General Examination : ☐ **Not examined** ☐ **Normal** ☐ **Not applicable**

☐	Pallor	☐	Flushed	☐	Clammy	☐	Sweating	☐	Cyanosed	☐	Jaundiced
Conscious state				**Clubbing**				**General appearance**			
☐	IS conscious	☐	AVPU response	☐	Present	☐	Staging				
Hydration											
☐	Odema	☐	Odema status	☐	Swollen eyes	☐	swollen legs				

SYSTEMIC REVIEW

CVS		OTHER SYSTEMS
Pulse		RS
Rate		
Rhythm		
Volume		
Character		P/A
Heart Sounds		
Crepitations		
Murmurs		
Bruits		OTHERS
JVP		
Peripheralpulses		

CARE HOSPITALS

Date & Time of first contact / arrival	
Time of Onset	

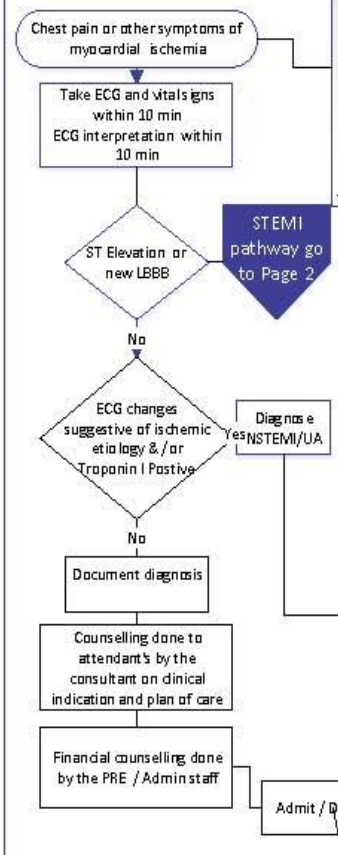
Cardiac Chest Pain Pathway – Documentation Template

☐ ER ☐ Ambulance ☐ OP ☐ Ward ☐ ICU 1 2 3 4 5 ER

Function

Pathway Inclusion Criteria

- ☐ chest pain presentations
- ☐ Patients coming from other hospitals with chest pain presentation
- ☐ Partial treatment done for chest pain , presenting to emergency
- ☐ Also include Epigastric discomfort jaw pain/arm pain , with associated symptoms like sweating, syncope, sudden onset of dyspnea, Orthopnea
- ☐ Patient presenting in cardiac arrest /with arrhythmia
- ☐ Include post thrombolysis /partially treated patients referred from other centers for further management. (With ongoing chest pain)



General Management on arrival (checklist)

- ☐ Oxygen - if Oxygen saturation < 94%
- ☐ IV Access
- ☐ Connected to Monitor
- ☐ Oxygen by NC/Mask
- ☐ Pain relief
- ☐ GRBS
- ☐ Draw samples for cath profle
- ☐ Tropinin I - If onset of pain is more than 6 hrs
- ☐ Not applicable

Time of completion: _____

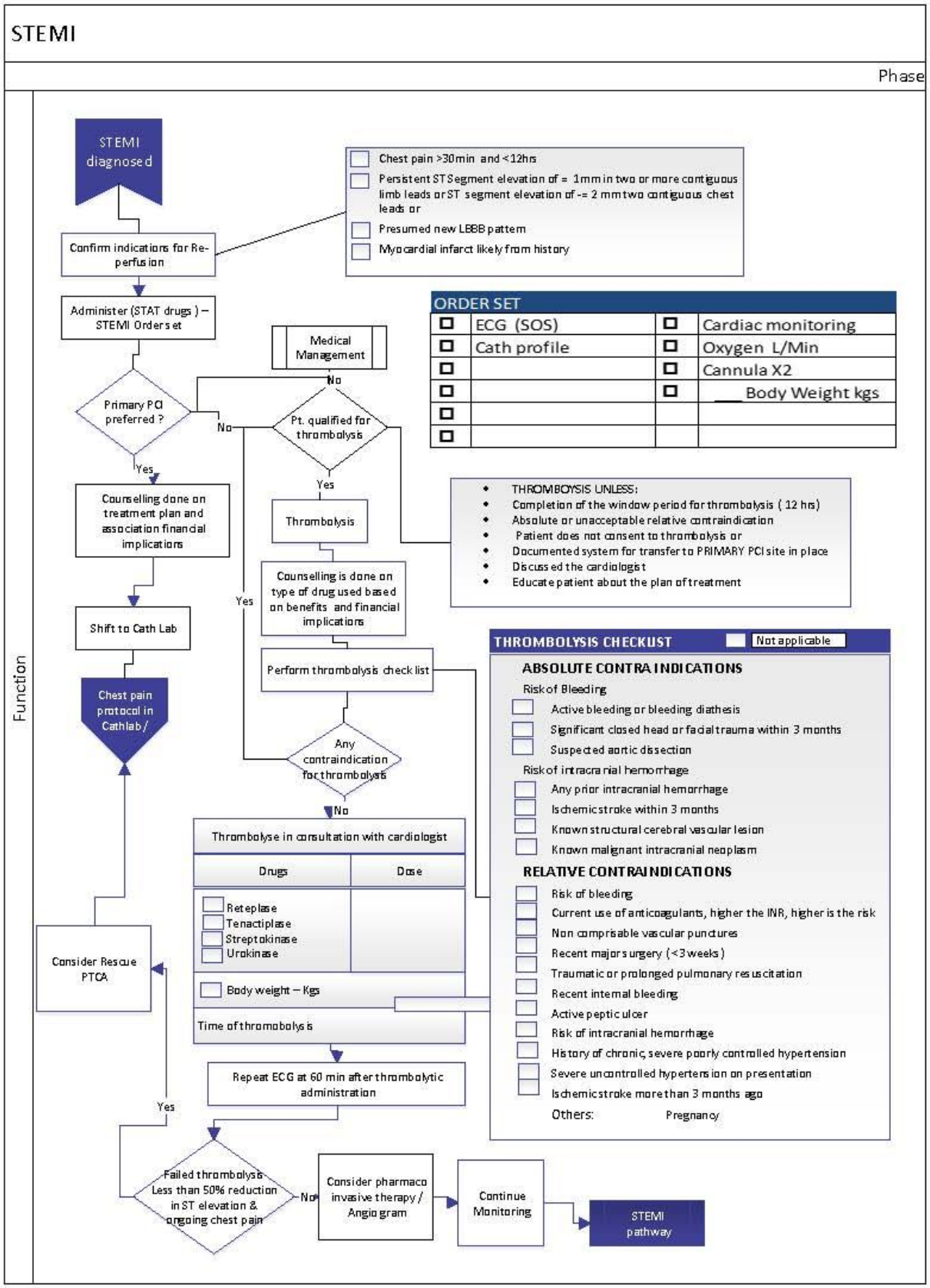
(To be completed with 15 min of arrival)

2D Echo Screening – 20 min

Time of first ECG	
Time of STEMI pathway activation (Otime)	
Kilip class	
Over all TIMI Score	

ECG FINDINGS (to be filled by DMO)

ECHO FINDINGS (to be filled by DMO)


STEMI
Phase
Function
STEMI diagnosed
Confirm indications for Re-perfusion
Chest pain >30min and <12hrs
Persistent ST Segment elevation of = 1mm in two or more contiguous limb leads or ST segment elevation of -= 2 mm two contiguous chest leads or
Presumed new LBBB pattern
Myocardial infarct likely from history
Administer (STAT drugs) – STEMI Orders et
ORDER SET
ECG (SOS)
Cardiac monitoring
Cath profile
Oxygen L/Min
Cannula X2
___ Body Weight kgs
Medical Management
Primary PCI preferred ?
No
Yes
Pt. qualified for thrombolysis
No
Yes
Counselling done on treatment plan and association financial implications
Thrombolysis
THROMBOYSIS UNLESS:
Completion of the window period for thrombolysis (12 hrs)
Absolute or unacceptable relative contraindication
Patient does not consent to thrombolysis or
Documented system for transfer to PRIMARY PCI site in place
Discussed the cardiologist
Educate patient about the plan of treatment
Counselling is done on type of drug used based on benefits and financial implications
Yes
Shift to Cath Lab
Perform thrombolysis check list
THROMBOLYSIS CHECKUST
Not applicable
ABSOLUTE CONTRA INDICATIONS
Risk of Bleeding
Active bleeding or bleeding diathesis
Significant closed head or facial trauma within 3 months
Suspected aortic dissection
Risk of intracranial hemorrhage
Any prior intracranial hemorrhage
Ischemic stroke within 3 months
Known structural cerebral vascular lesion
Known malignant intracranial neoplasm
RELATIVE CONTRAINDICATIONS
Risk of bleeding
Current use of anticoagulants, higher the INR, higher is the risk
Non comprisable vascular punctures
Recent major surgery (<3 weeks)
Traumatic or prolonged pulmonary resuscitation
Recent internal bleeding
Active peptic ulcer
Risk of intracranial hemorrhage
History of chronic, severe poorly controlled hypertension
Severe uncontrolled hypertension on presentation
Ischemic stroke more than 3 months ago
Others: Pregnancy
Chest pain protocol in Cathlab /
Any contraindication for thrombolysis
No
Thrombolyse in consultation with cardiologist
Drugs
Dose
Reteplase
Tenactiplase
Streptokinase
Urokinase
Body weight – Kgs
Time of thrombolysis
Consider Rescue PTCA
Repeat ECG at 60 min after thrombolytic administration
Yes
Failed thrombolysis Less than 50% reduction in ST elevation & ongoing chest pain
No
Consider pharmaco invasive therapy / Angiogram
Continue Monitoring
STEMI pathway

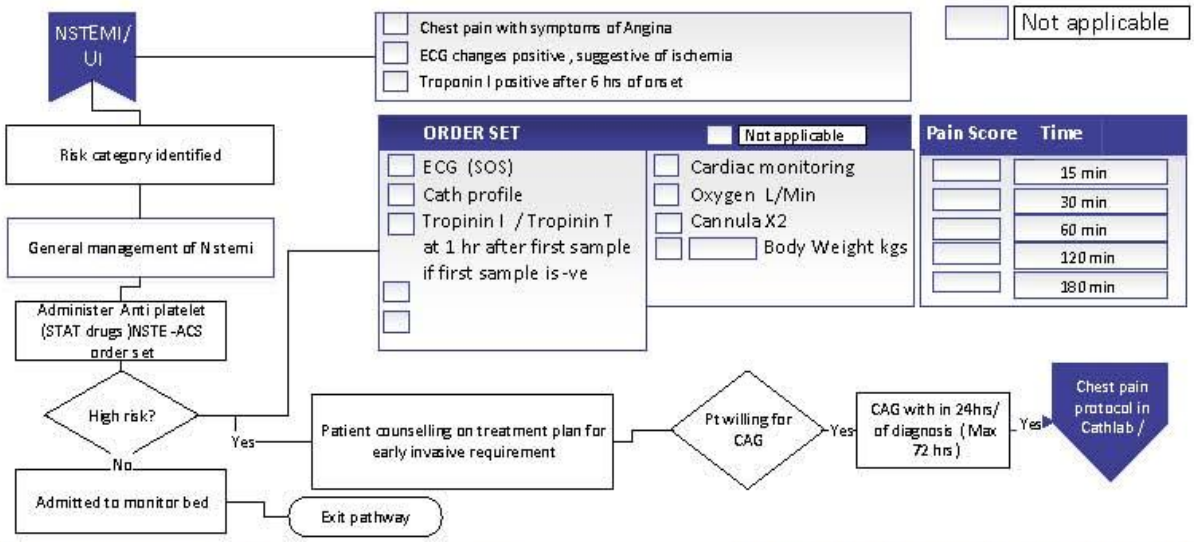
STEMI ORDER SET

Not applicable

Drug order set in STEMI	Dose	Route	√√	Dr Sign	Nurse
***Aspirin Chewable** (Disprin)	300mg	oral			
***Nitrates**					
Sorbitrate	5 mg /10 mg	SL			
NTG	Start @ 2.5 mcgs/min	IV			
Avoid/ consult cardiologist in case of IW/RVMI	(titrate in 2.5 mg increments till pain free* or SBP</= 100mmhg)				
***Clopidogrel**	600mg	PO			
Prasugrel**	60 mg				
	(Check for contraindications. Age>75, History of stroke/TIA, Wt<60 kgs.)	PO			
Ticagrelor**	180 mg	PO			
***Heparin Bolus**	60 IU/kg	IV			
Heparin Infusion**	12IU/ kg/ hr				
	If thrombolysis is planned consult cardiologist before starting infusion	IV			
LMWH					
Enoxaparin **	1mg/kg	IV Stat then S/C bid			
***Atorvastatin**	80 mg	p/o			
**Morphine ** **	2.5 mg stat Total Dose:_____ mg.				
Avoid if pain is subsiding with Nitrates and antiplatelets	(Titrate in increments of 2.5 mg if pain not subsiding with NTG, Give Ondansetron 8 mg as premedication. Avoid in RVMI)	I/v			
	Naloxone on standby if total dose is exceeding 0.1 mg/kg				
Beta blocker **	Consult cardiologist before administering				
	Avoid in RVMI and in presence of Bradycardia	P/O, IV			
Drug **Metoprolol**	_____ mg. Stat.				
Pantoprazole*	40 mg	IV			
Emeset*	8mg	IV			
Thrombolytic therapy					
Reteplase	10 gms two doses 30 min apart administered over 2 min L	IV Bolus			
Tenactiplase	40 mg administred over 5 seconds	IV Bolus			
Streptokinase	1.5mu in 50 ml of Normal Saline over 45 min	IV			
OTHER DRUGS / Infusions					

ACS RISK STRATIFICATION (To be completed within 30 Min of arrival by specialty consultant) ☐ Not applicable

HIGH RISK Any one of the following	INTERMEDIATE RISK Any one of the following and No High risk features	LOW RISK (Any one of the following No intermediate of High risk features)
☐ ACS Symptoms are repetitive or prolonged (>10 min) & still present ☐ Syncope ☐ History of Chronic LV Dysfunction (known LVEF<40%) or current clinical evidence of LVF ☐ Previous PCI/CABG<6 months ☐ Diabetes + typical ACS symptoms ☐ Chronic renal failure + typical ACS symptoms ☐ Hemodynamic compromise (sustained SBP <90mmHg and /new mitral regurgitation ☐ Elevated Troponin (consider hemolysis , renal failure)	☐ ACS Symptoms within 48 hours that occurred at rest , or were repetitive or prolonged (but currently resolved) ☐ Previous PCI/CABG<6 months ☐ Known coronary artery disease – Esp if prior AMI or known coronary lesion >50% stenosis ☐ Two or more risk factors of : Hypertension, family history, active smoking or hyperlipidemia ☐ Chronic renal failure (if known GFR<60 mL/min + atypical ACS symptoms Diabetes + atypical ACS symptoms Age >65 years	☐ Presentation with clinical features consistent with ACS without intermediate risk – or high risk features
☐ Persistent or dynamic ECG changes of IST depression = 0.5 mm or new T wave inversion =2mm ☐ Transient ST Elevation (=0.5 mm) in more than two contiguous leads Sustained VT	☐ ECG normal and has changed from previous pain free ECG but does not contain high risk changes	☐ ECG normal and has un changed from previous pain free ECG
HIGH RISK Yes ☐ No ☐ Time:	INTERMEDIATE RISK Yes ☐ No ☐ Time	LOW RISK Yes ☐ No ☐ Time
HIGH RISK ☐ Continuous cardiac monitoring – vital signs ☐ Repeat ECG if symptoms reoccur ☐ Repeat ECG 6 hrs post onset of symptoms ☐ Repeat Troponin after 1 hr of 1st sample is -ve , if onset is less than 6 hrs ☐ Repeat Troponin after 6 hrs ☐ ECG/Troponin review by specialty consult	**INTERMEDIATE RISK** **Restratify** ☐ Continuous cardiac monitoring – vital signs ☐ Repeat ECG if symptoms reoccur ☐ Repeat ECG 6 hrs post onset of symptoms ☐ Repeat Troponin after 1 hr of 1st sample is -ve , if onset is less than 6 hrs Repeat Troponin after 6 hrs ECG/Troponin review by specialty consult	**LOW RISK** ☐ Regular vital signs ☐ Repeat ECG if symptoms reoccur ☐ Repeat ECG 6 hrs post onset of
		☐ Regular vital signs ☐ Repeat ECG immediately if symptoms recur ☐ Repeat ECG 8 hrs post onset of symptoms Repeat Troponin at 8 hrs if 1 sample
Anti platelet therapy ☐ Yes ☐ No Reason for No _____ Beta Blocker ☐ Yes ☐ No Reason for No _____ Anti coagulantT ☐ Yes ☐ No Reason for No _____	☐ Refer to Stress Test IF : ☐ No Further Chest pain / Symptoms ☐ 2 Negative Troponin tests ☐ No New ECG changes ☐ No contraindications to stress test	Restratify Risk if: ☐ Recurrent ishaemic chest pain or ☐ Postiive Troponin or ☐ New ECG changes
☐ Symptomatic treatment of ongoing pain / hypertension ☐ IV Morphine ☐ Referral / Admission to cardiologist ☐ Consider Intervention on Admission ☐ Consider Glycoprotein 2B III inhibitor	☐ Re stratify to High Risk ☐ Recurrent Ischemic chest pain or positive Troponin or New ECG changes	If Low Risk ACS ☐ Discharge in consultation with cardiologist ☐ Consider discharge on Aspirin Vital signs prior to discharge
	☐ Re stratify to Low Risk & Discharge if ☐ Negative stress test ☐ No further chest pain or symptoms ☐ Repeat ECG & vital signs , if stable discharge ☐ Consider Intervention on Admission ☐ Consider Glycoprotein 2B III inhibitor	☐ If unlikely cardiac cause ☐ Consider alternative diagnosis ☐ Provide reassurance / Treatment ☐ Document alternate diagnosis ☐ Discharge ☐ Exit Pathway Exit time



Drug order set in NSTE- ACS	Dose	Route	√	Dr Sign	Nurse	Time
***Aspirin Chewable** (Disprin)	300mg	oral				
***Nitrates**						
Sorbitrate	5 mg /10 mg	SL				
NTG	Start @ 2.5 mcgs/min	IV				
	(titrate in 2.5 mg increments till pain free* or SBP</= 100mmhg)					
***Clopidogrel**	300mg	PO				
Prasugrel**	60 mg (Check for contraindications. Age>75, History of stroke/TIA, Wt<60 kgs.)	PO				
Ticagrelor**	180 mg	PO				
***Heparin Bolus**	60 IU/kg	IV				
***Heparin Infusion**	12IU/ kg/ hr	IV				
LMWH						
Enoxaparin **	1mg/kg	IV Stat thenS/C bid				
***Atorvastatin**	80 mg	p/o				
*Pain Relief	Perform ECG in case of continuing pain/ increase in pain score if already on nitrates					
	Go to STEMI in case of ST elevation - Give Morphine as per STEMIpathway					
Beta blocker **	Consult cardiologist before administering					
	Avoid in presence of Bradycardia, or Hypotension					
Drug: Metoprolol	_____ mg. Stat Consult cardiologist before administering	P/O, IV				
GIII2B3A inhibitors **	_____ mcgs/kg/minConsult cardiologist before administering	IV				
Pantoprazole	40 mg	IV				
Emeset*	8mg	IV				
Others:						

Drug order set other than loading doses				
Drug /Dose/Route	Dosage	Duration	Doc. Name	Doc.Sign

Other Instructions

Monitoring Chart										
	1st Hour	2nd Hour	3rd Hour	4th Hour	5th Hour	6th hour	7th hour	8th hour		
Heart Rate										
Systolic BP										
Diastolic BP										
MAP										
Respiratory Rate										
Temperature										
Sp02										
GCS										
Pain Score										
GRBS										

✓	Chest pain investigation panel (Secondary Order Set)					
	Investigation	Sent time	Result	Time	Nurse sign if oral	Inf given by
☐						
☐						
☐						
☐						
☐						
☐						
☐						
☐						
☐						

Kilip class	
Kilip Class	Condition
Class I	No evidence of LV dysfunction, absence of pulmonary congestion, normal systemic perfusion
Class II	BP normal, 2 of the following findings: basal rales, S3, cardiomegaly on chest X-ray
Class III	Pulmonary edema with preserved BP
Class IV	Cardiogenic shock - hypoperfusion and Pulmonary edema

TIMI score		
Parameter	Check if applicable	If Yes Score
Age <65		0
Age 65-74		2
Age >75		3
DM/HTN		1
Systolic BP < 100 mmHg		3
Heart Rate > 100		2
Kilip Class II-IV		2
Weight <67 Kg (147.7 lbs)		1
Anterior ST Elevation or LBBB		1
Time to Treatment > 4 Hours		1
TIMI Score		

CLINICAL NOTES - (If there is any deviation from order set - justification for the same to be captured)

Provisional Diagnosis	
Care Plan	
Treatment plan explained to patient	☐ Yes ☐ No — Explained by

STEMI		NON ST ELEVATION ACS		NON CARDIAC DIAGNOSIS	
☐	Primary PCI	☐	High Risk	☐	ALTERNATE DIAGNOSIS
☐	Shifted to Cath lab Time_____	☐	Intermediate Risk		
☐	THROMBOLYSED	☐	Low Risk		
☐	Perfusion Achieved ☐ Yes ☐ No				
☐	Time of exit from ER -_____	☐	Time of exit from ER -_____	☐	Time of exit from pathway_____
☐	ADMITTED	☐	ADMITTED	☐	ADMITTED
☐	PT. SHIFTED TO_____	☐	PT. SHIFTED TO_____	☐	PT. SHIFTED TO_____
☐	DISCHARGED	☐	DISCHARGED	☐	DISCHARGED
☐	LAMA	☐	LAMA	☐	LAMA
☐	DEATH	☐	DEATH	☐	DEATH

ER NURSE SIGNATURE	ER PHYSICIAN SIGNATURE	DMO SIGNATURE /CONSULTANT SIGN.
NAME	NAME	NAME
DATE& TIME	DATE &TIME	DATE &TIME

Nurses Progress notes

CLINICAL NOTES (For DMO /Consultant at ER for additional inputs)

4.10Pathway audit tool-

Attached in annexure

4.11 Door to balloon time audit tool--the amount of time between heart attack patient's arrival at the hospital (ER) to the time he/she receives percutaneous coronary intervention (PCI) is called Door to Balloon time

ADITYA CARE HOSPITAL
BHUBANESHWAR

DOOR TO BALLOON TIME APRIL'16

SL.NO.	IP.NO.	ARRIVAL TIME IN ER	BALLOON TIME	DOOR TO BALLOON TIME	SPECIAL PROCEDURE	Remarks
1	37989	9.50 AM	1.05 AM	3HR10 MIN	PRIMARY PTCA TO LAD	
2	38008	11.00 AM	1.00 PM	2 HR	PRIMARY PTCA TO LAD	
3	38012	11.55 AM	2.30 PM	2 HR 35 MIN	PRIMARY PTCA TO LAD	
4	38016	3.40 PM	6.00PM	2HR20 MIN	PRIMARY PTCA TO LAD	
5	38019	10 .00PM	11.45 PM	1HR45 MIN	PRIMARY PTCA TO LAD	
6	38116	2.30 PM	4.40 PM	2 HR10 MIN	PRIMARY PTCA TO LAD	
7	38100		7.10 PM	1HR 3 MIN	PRIMARY PTCA TO LAD	6.13 PM ARRIVAL IN BIILING SHEET
8	38306	3.15 PM	7.28PM	4HR16 MIN	PRIMARY PTCA TO LAD	
9	38297	7.00 AM	7.40 AM	40 MIN	PRIMARY PTCA TO LAD	
10	38217	9.15 PM	12.05 AM	2 HR 50 MIN	PRIMARY PTCA TO LAD	
11	38362	12.00 PM	1.45 PM	1 HR 45 MIN	PRIMARY PTCA TO LAD	
12	38410	12.50 pm	3.00 PM	2 HR10 MIN	PRIMARY PTCA TO LAD	
13	38446	9.45 pm	11.30 PM	1HR45 MIN	PRIMARY PTCA TO LAD	

AVG TIME= 2 HR 19 MIN

5 Analysis of study and compliance-

Documentation compliance%		
	Apr-16	
General management checklist	80%	
Triage	98%	
Time of onset	95.00%	
2D echo advise	100%	
2 D ECHO Documentation	98%	
ECG documentation	95%	
Exit time	27%	
DMO sign (accountability)	91.66%	
DMO time (accountability)	20.00%	
ERP sign (accountability)	88.33%	
ERP time (accountability)	68.33%	
Nurse sign(accountability)	100%	
Nurse time(accountability)	93%	
Risk assessment	90%	
Drug order set	100%	
investigation order set	100%	
Net compliance index (out of 10)	***8.4***	

Table no. 5.1 documentation compliance

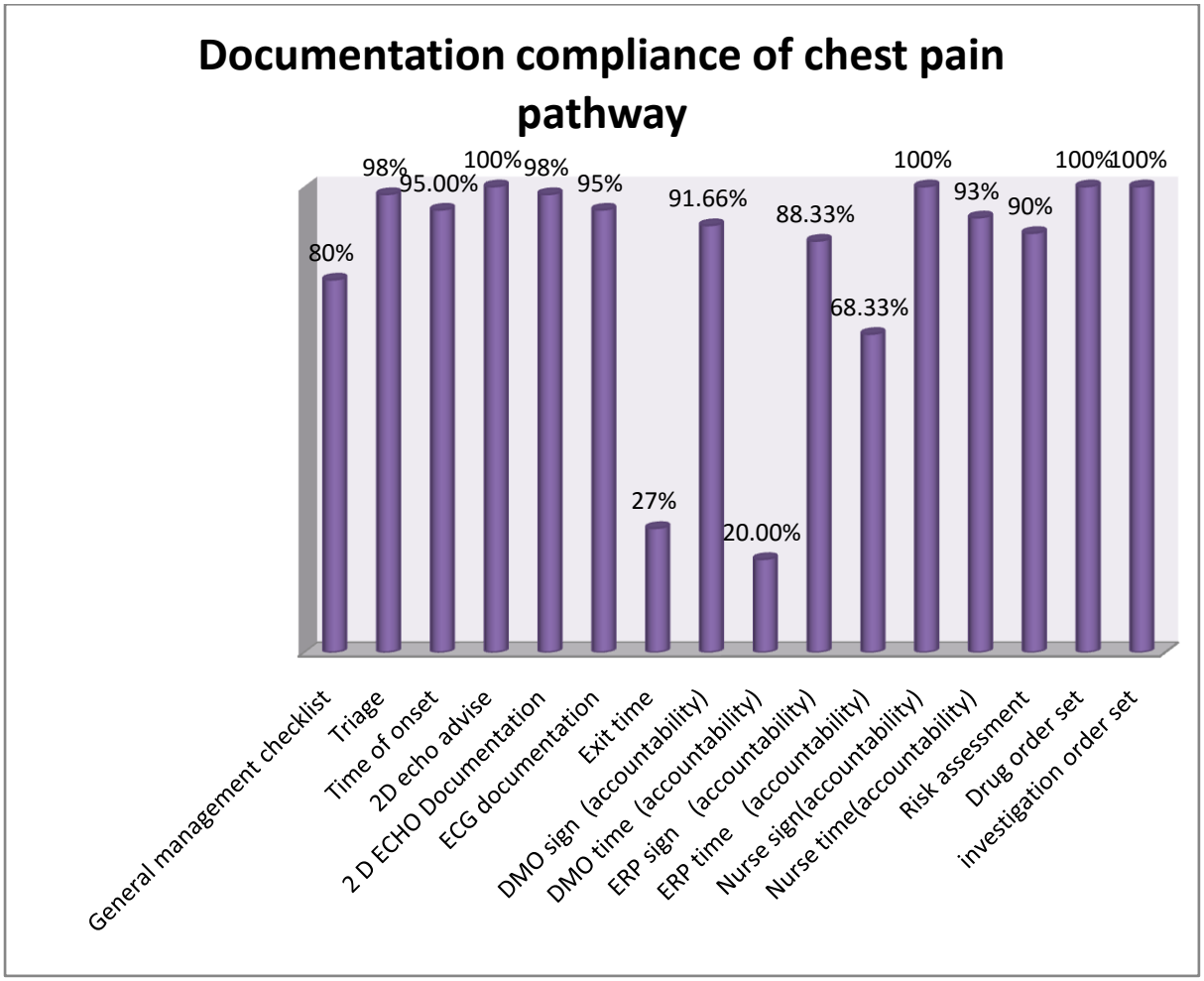


Fig.no.5.1 documentation compliance

Data points ERP is expected to capture		
Time of arrival	100%	
Time of onset of symptoms	95%	
Triage	98.33%	
Pt. complaints	98.33%	
Net compliance index (out of 10)	***9.7***	
DMO/consultant		
ECG finding	100%	
2 D ECHO Finding	98.33%	
Risk stratification	90%	
chest pain pathway inclusion criteria	100%	
Net compliance index (out of 10)	***9.7***	
NURSING		
Vitals	100%	
General management checklist	80%	
Exit time	` 27%	
Net compliance index (out of 10)	***6.9***	

Table no.-5.2 ERP/DMO/Nursing Data Capture Compliance

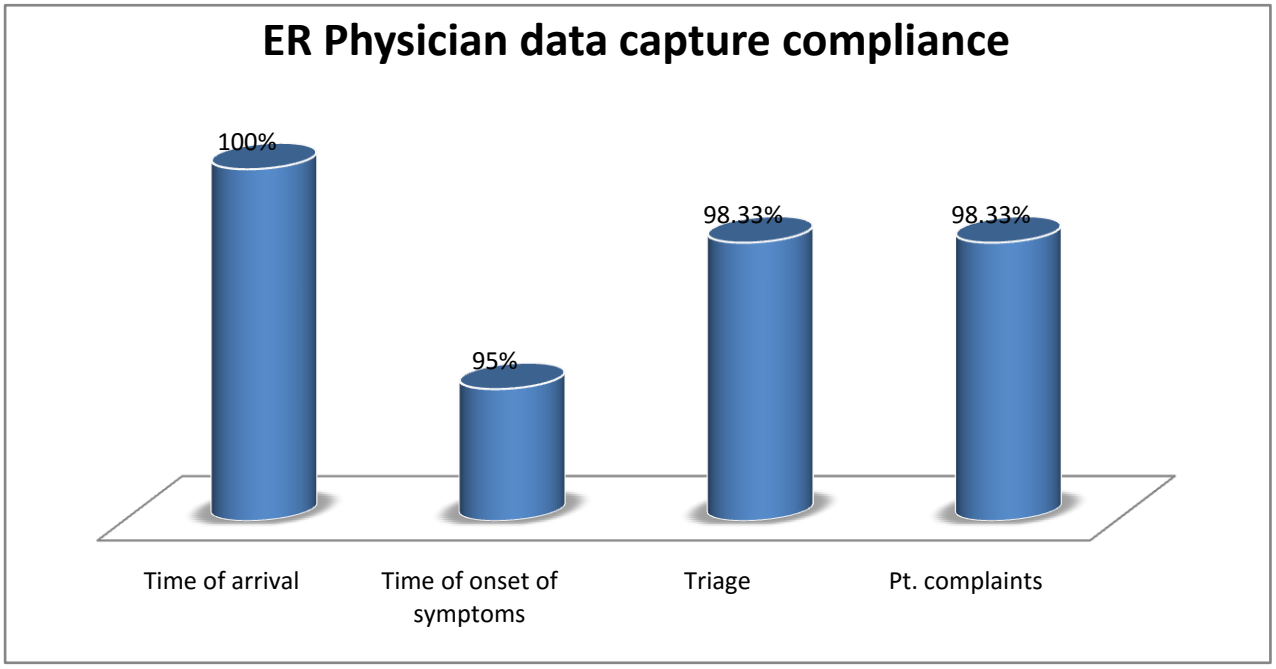


Fig.no.5.2 ERP data capture compliance

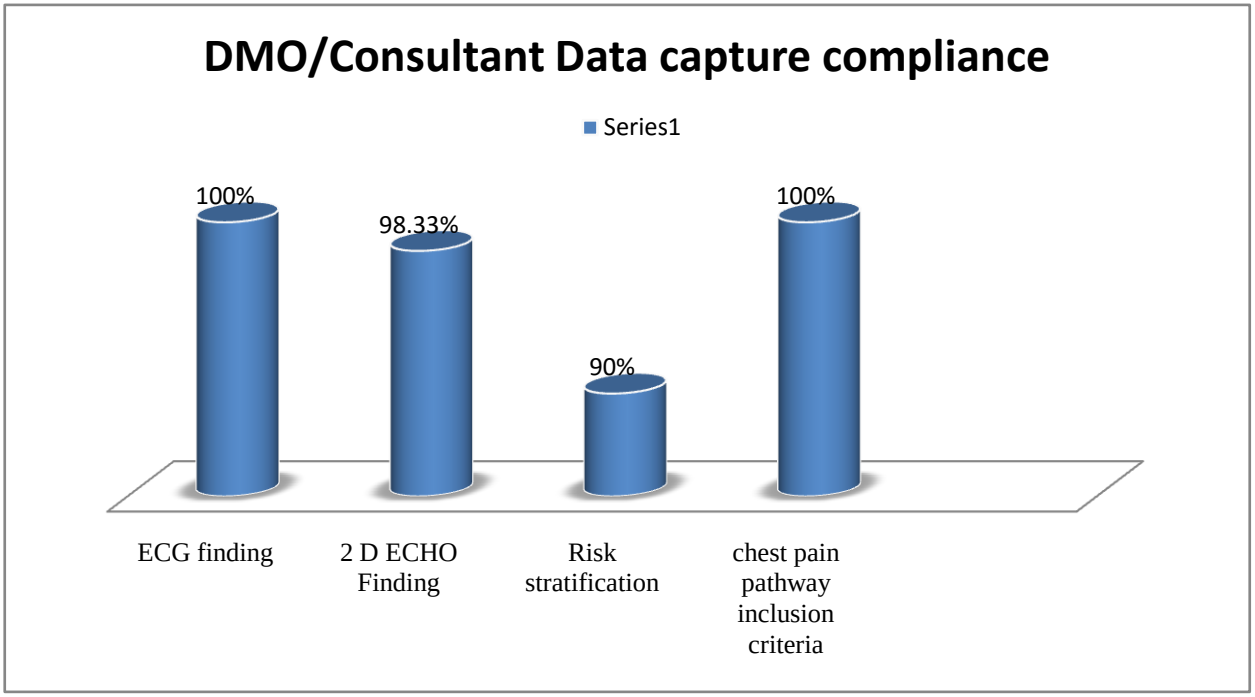


Fig.no.5.3 DMO data capture compliance

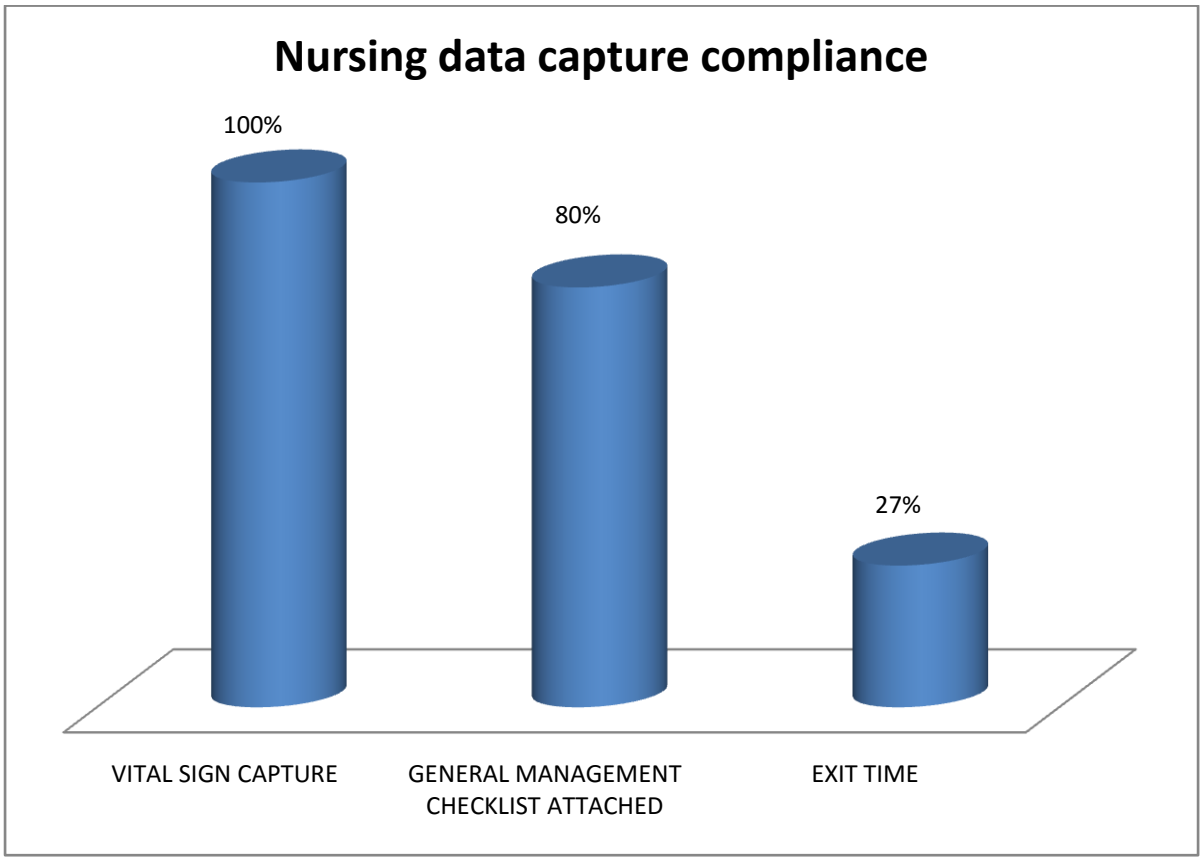


Fig.no.5.4Nursing data capture compliance

patient safety audit	
Number of case sheet audited	60
total events	15
Number of patients with events	25
Number of patients having more than 3 events	1
Number of events documented in the patient safety sheet	25
Number of event missed	0

Table no.5.3 Patient safety audit data

% compliance of patient safety	
Patient event captured	41.66%
Non event	58%
Number of patients having more than 3 events	1.66%
Number of events documented in the patient safety sheet	100%
Number of event missed	0%

Table no.5.4 Patient safety audit compliance

MAJOR EVENTS	
Onsets of fever	7
Phlebitis	1
Hypokalemia	8
Hyponatremia	3
Hematoma	3
pressure ulcer	0
medication error	2
documentation error	1

Table no.5.5 Major events in patient safety audit

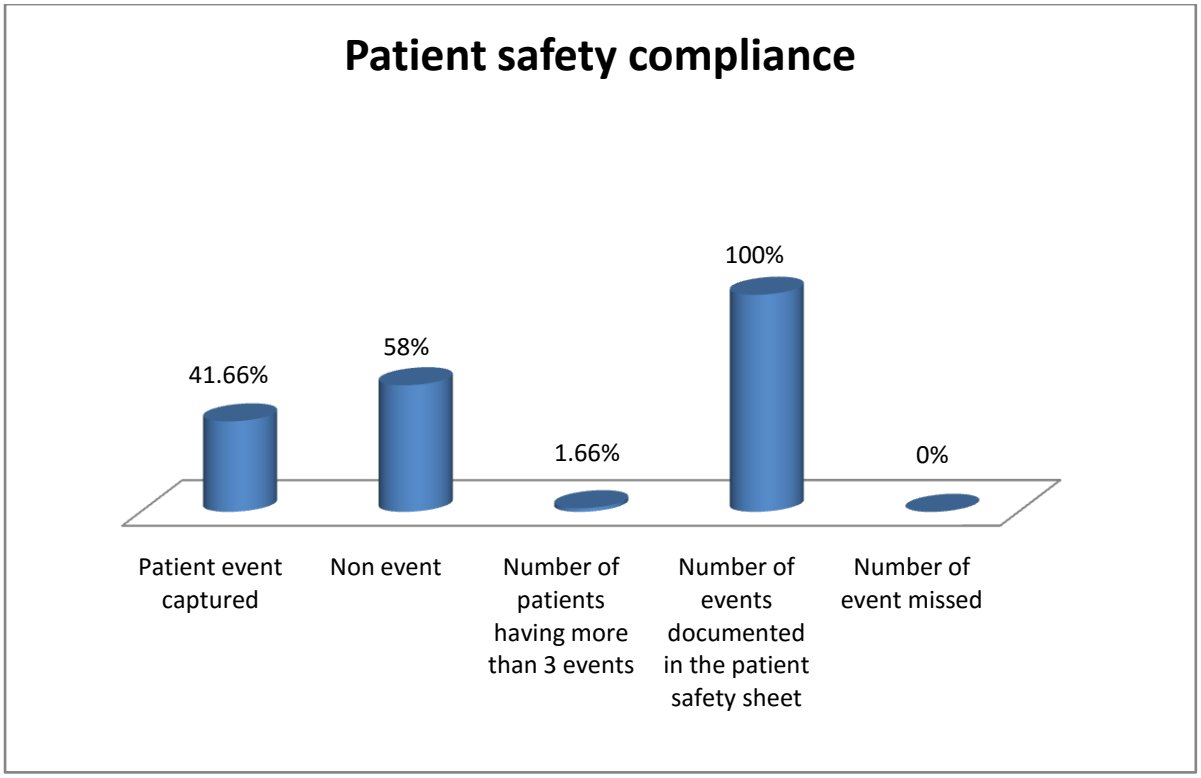


Fig.no.5.5 Patient safety audit compliance

PAST HISTIRY	
HTN	19.00%
DMT1	1.66%
DMT2	6%
HTN,DMT2	16.66%
CAD	3.33%
POST CABG	3.33%
SMOKING	5%
DM/HTN/COPD	6.66%
NO HISTORY OF SPECIFIC DISEASE	31.66%
HISTORY NOT DOCUMENTED	3.33%
OTHERS	3.30%

Table no.5.6 past history of patients

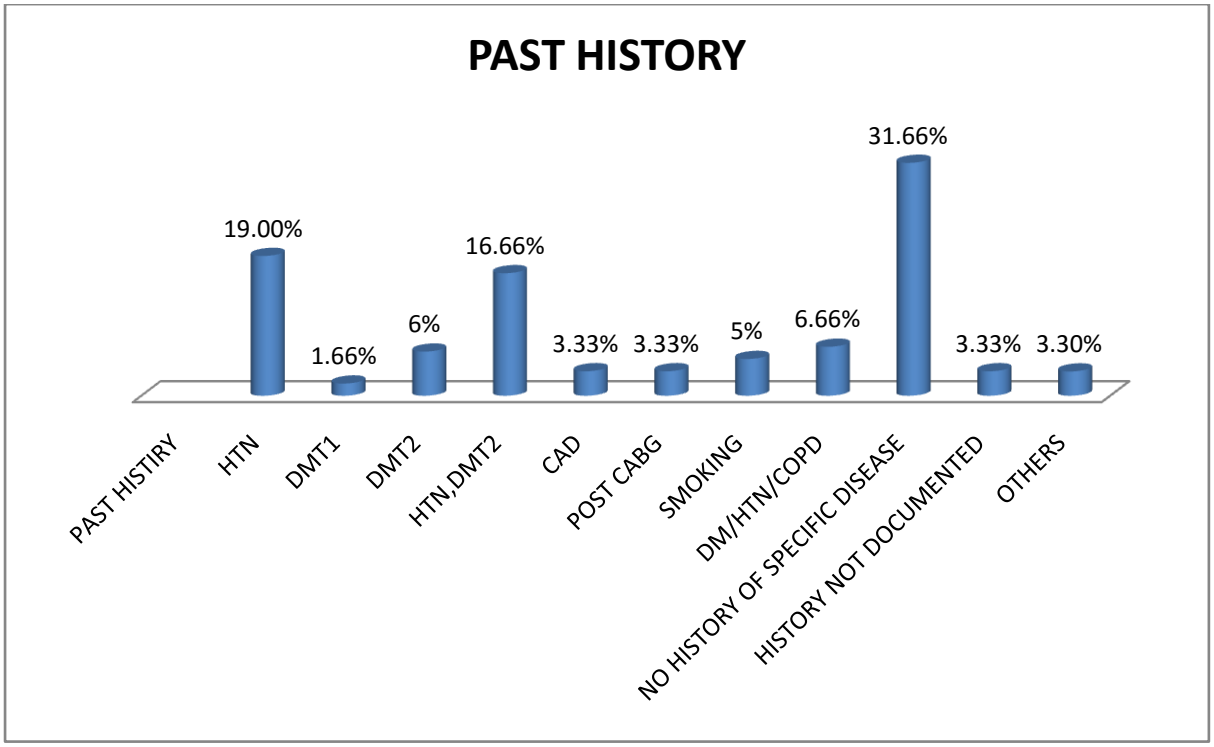


Fig.no.5.6 Past history compliance

Chest pain pathway Medication Order -set compliance		
Aspirin full dose	26.66%	
Aspirin 150	41.66%	
Aspirin 75	8.33%	
outside	21.66%	
Not documented	1.66%	
Clopidogrel full dose	30%	
Clopidogrel 150	0%	
Clopidogrel 75	43.33%	
outside	21.66%	
not documented	5%	
NTG	3.33%	
Heparin	36.66%	
Statin full dose	67%	
40 mg	18.30%	
20 mg	0%	
Outside	15%	
Not documented	0%	
Pan	67%	

Table no.5.7 drugs compliance

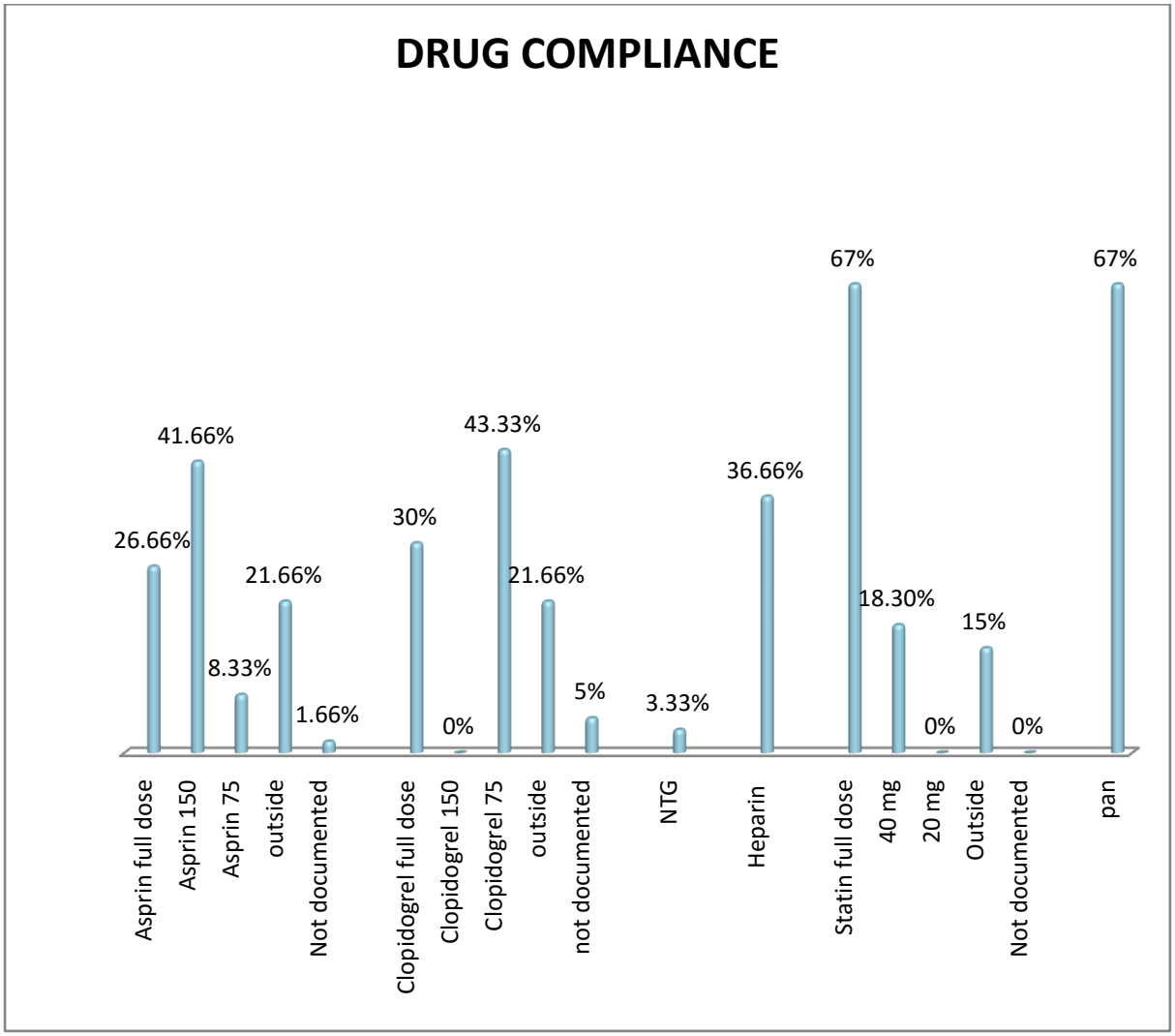


Fig.no.5.7 drug compliance

PT SHIFTED FROM		
Outside	47	78.33%
Direct admission	13	21.67

Table no.5.8 Number of patients coming from outside and direct admission

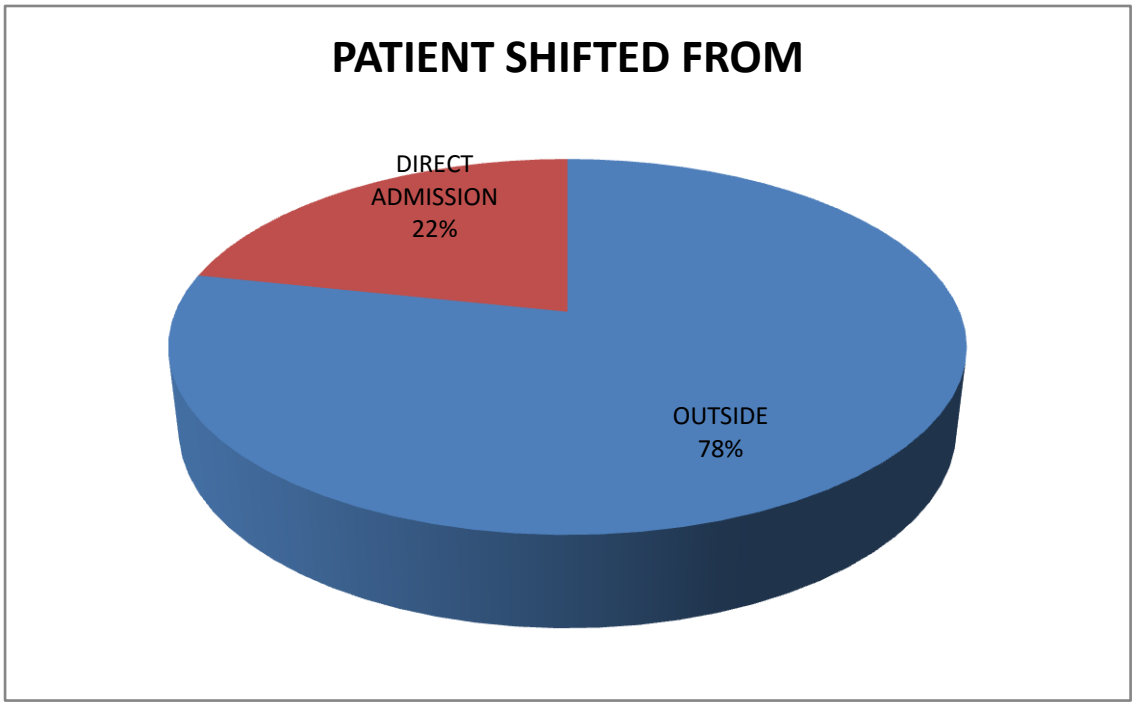


Fig no.5.8 Number of patients coming from outside and direct admission

PROCEDURES		
CAG	26	43.33%
CAG+PTCA	17	28.33%
CAG,CAGB	2	3.33%
MEDICAL MANAGEMENT	15	25%

Table no.5.9 patient management data by medical management or procedures

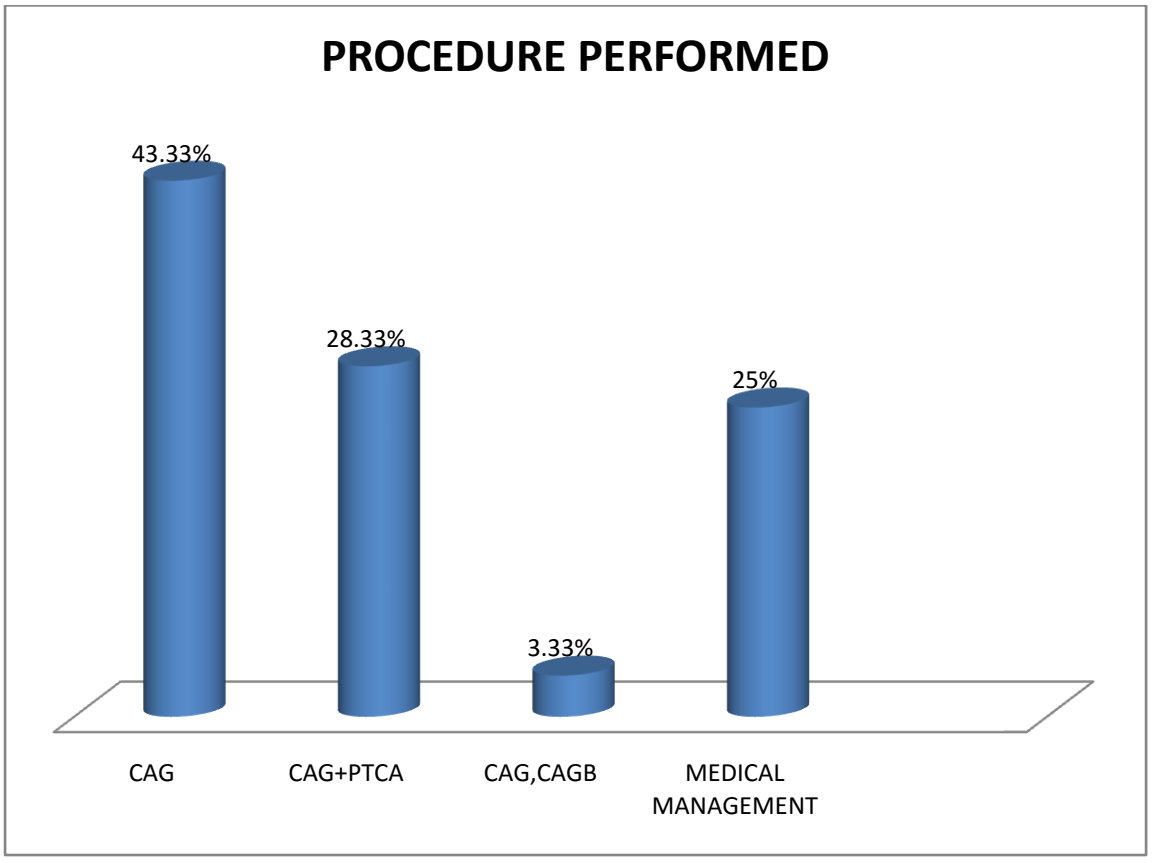


Fig.no.5.9patient management data by medical management or procedures

ALOS		SET STANDARDS
ER ALOS	5.66 HRS	8 HRS
ALOS CHEST PAIN PATIENT IN HOSPITAL	5.26 DAYS	

Table no.5.10 average length of stay of chest pain patients in emergency

AVG TIME		SET STANDARDS
ECG	7.43 MIN	10 MIN
ECHO	17.58 MIN	20 MIN

Table no.5.11 average time of ECG and Echo

DOOR TO BALLOON TIME		SET STANDARDS
April 16	139 MIN	90 MIN

Table no.5.12 door to balloon time

Mortality rate	Deaths	
April 16	5	8.335%

Table no.5.13 number of deaths out of 60 chest pain patients

6 Comparison of compliance of past months-

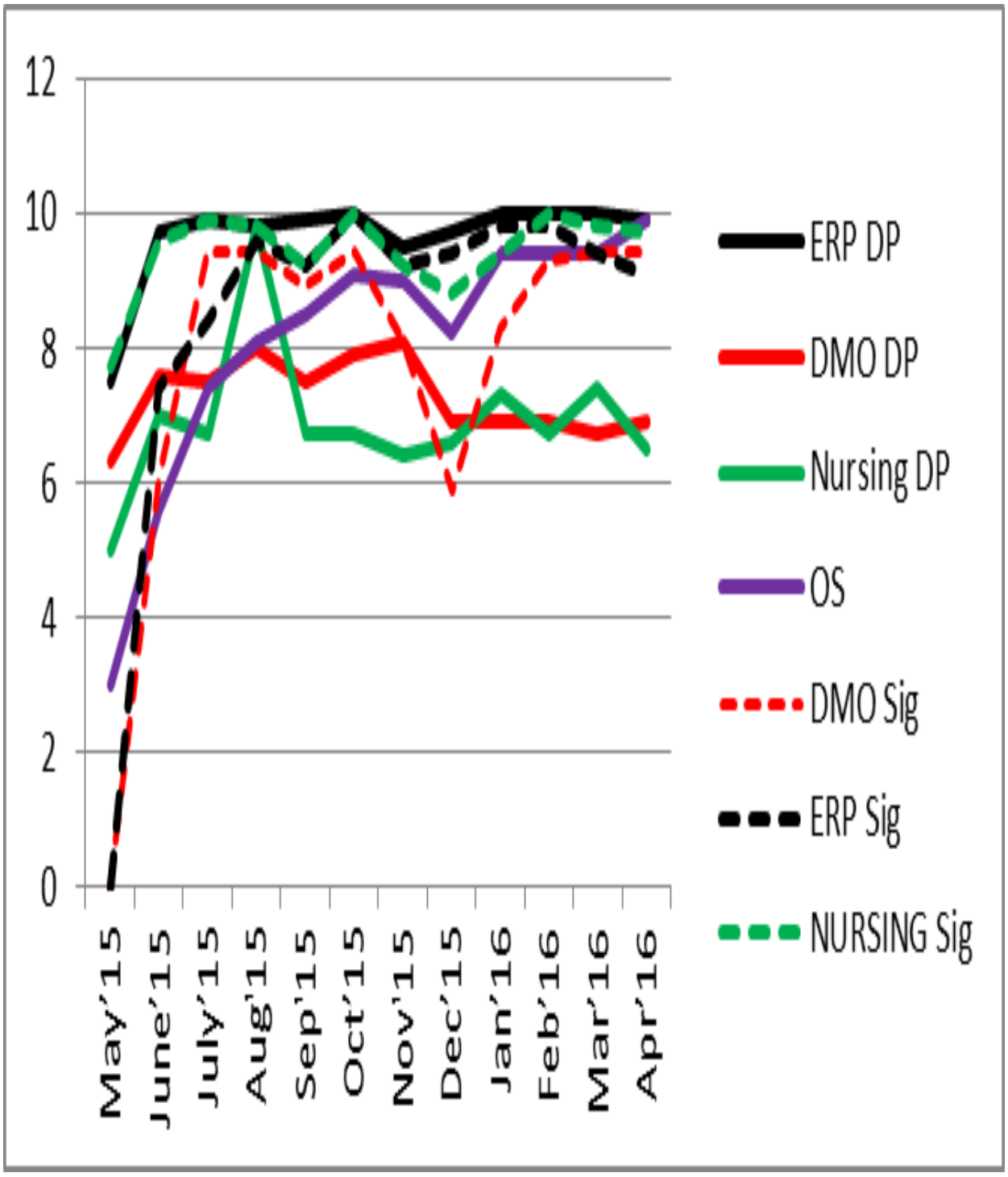


Fig.no. 6.1 comparison of Chest pain compliance from past months

7Conclusion-

Chest pain pathway is followed by the doctors as well as nursing staff. Over all compliance is improved in comparison of past months but many things still need to improved

1.Door to balloon time is more than set standards.

Causes-more time is consumed in convincing the attendants about the diagnosis and procedures and cost of procedures.

- Decision making delay by the patient attendants and confusion about cost of procedure.

-delay in consent taking for the procedure.

2. Accountability compliance of DMO and ER physician is low than desired level.

3. General management checklist compliance is low.

4. Aspirin initial dose not documented in 1.66% cases.

Note- it is given to the patient in emergency department but not documented in pathway sheet, it is documented in progress notes.

5. Clopidogrel is not documented in 5% case.

Note-written in progress sheet but not documented in Chest pain sheet.

6. Average ECG and ECHO time is under 10 min. and 20 min. respectively which is good achievement.

7. Average hospital stay of STEMI/NSTEMI/UA patients is 5 days.

8. Maximum number ofchest pain patients coming after taking the primary treatment

(78%), only 22%patients are directly coming.

9.Patient safety check - Major patient safety events are fever, Haematoma after PTCA and thrombophlebitis.

Causes-

-There total 7 case of fever out of them in 5 cases fever developed after coming from the cathlab ,it indicates the infection is coming from the Cath lab.

- 3 Cases Haematoma developed after the PTCA procedure it indicates the procedural injury.

-Electrolyte imbalance found in 11 cases which is due to pathophysiological changes after the MI or Angina.

-Thrombophlebitis due to dobutamin support.(As ICUincharge said)

-2 cases of medication administration error and 1 case of documentation error were captured

10. The incidence of coronary heart disease is high in patients who havehistory of HTN and diabetes mellitus.

8Recommendations-

1.Continuous Training programmes are needed for nursing staff to improve the compliance and to make them moreaware about the utility of Chest pain pathway .

2. Accountability documentation (sign/time) of doctors is very important factorwhich need to be improved by directly talk with doctors and convince them for doing it

3.for decreasing the door to balloon time-

- Proper process flow is needed to guide and council the patient attendants about the procedure, clearing the financial doubts and help them in decision making .for this training programmes should conducted for patient relation executives.
- Doctors can take the help of audio-visual aids to council them to and to help them in fast decision making.

4. Proper infection control measures need to be taken in cath lab before and during the procedure.

5.To avoid the medication errors training of 10 rights is necessary.

(Right Patient,Right Time Right dose,Right frequency, Rightmedication, Rightroute, Right Client education, Right assessment, Right evaluation ,Rightto refuse)

9. Limitation of study-

1.One month data is collected due to engaged in other project.

2.Convenient sampling is done, bed side study is only done (between 9 pm to 6 pm).

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11 Annexure-

11.1 Chest pain Pathway tool

Sr. no.	Patient name	Consultant name	IP no.	Unit name	Date of admission	Time of arrival
1.				BBSR		
60.						

Sr.no.	triage	General management checklist	Vitals taken	Patient complain documentation	Time of Onset recorded	ECG time (min.)
1.						
	Response	Response-	Response-	Response-	Response-	
	Resuscitative	yes	yes	Yes	yes	
	Urgent	no	no	No	no	
	Emergent					
	Less urgent					
60.						

Sr.no.	ECG documentation	2D Echo time(min.)	2DEcho Documentation	Chest pain inclusion criteria documented	Patient shifted from outside	Exit time (min.)	ALOS (ER.)
1.							
	Response-		**Response-**	**Response-**	**Response-**		
	yes		**yes**	**Yes**	**yes**		
	no		**no**	**No**	**no**		
60.							

Sr.no.	DMO sign	DMO time	ERP sign	ERP time	Nursing Sign	Nursing Time
1.						
	Response-	**Response-**	**Response-**	**Response-**	**Response-**	**Response-**
	yes	**yes**	**yes**	**Yes**	**yes**	**yes**
	no	**no**	**no**	**No**	**no**	**no**
60.						

Sr.no.	diagnosis	Drug order set	Investigation order set	Aspirin dose	Clopidogrel dose	Statin dose
1.						
		Response-	**Response-**			
		yes	**yes**			
		no	**no**			
60.						

Sr.no.	NTG dose	Heparin dose	pantocid	Procedure performed	Primary patient	Risk stratification
1.						
					Response-	
					yes	
					no	
60.						

Sr.no.	Troponin T/I	DMO Name	Patient event	death	Length of stay in hospital	Past history	investigation
1.							
				Response-			
			Eg.	**yes**			
			Fever	**no**			
			Hypokalaemia				
			Hypernatremia				
			Bed sore				
60.							

11. 2 Definitions-

11.2.1**ST ELEVATION MYOCARDIAL INFRACTION (STEMI)**

ST-Elevation Myocardial Infarction (STEMI) is a very serious type of heart attack during which one of the heart's major arteries (one of the arteries that supplies oxygen and nutrient-rich blood to the heart muscle) is blocked. ST-segment elevation is an abnormality detected on the 12-lead ECG.Electrocardiogram with ST-segments elevated It is a profoundly life-threatening medical emergency and usually associated with a disease process called atherosclerosis (coronary artery disease). Patients experiencing acute STEMI are at risk for developing life-threatening arrhythmias like ventricular fibrillation which causes sudden cardiac arrest, sometimes referred to as a "massive heart attack". These patients require cardiopulmonary resuscitation (CPR) and defibrillation — a "shock" to restore a normal heart rhythm.

Signs and symptoms of a STEMI include:

- Chest pain or discomfort
- Shortness of breath
- Dizziness or light-headedness
- Nausea or vomiting
- Diaphoresis (sweatiness) unexplained by ambient temperature
- Palpitations (uncomfortable awareness of the heart beat)
- Anxiety or a feeling of impending doom

11.2.2 NON STEMI AND UNSTABLE ANGINA-

Unstable angina (UA) and non-ST elevation (non-Q wave) myocardial infarction (NSTEMI) differ primarily in whether the ischemia is severe enough to cause sufficient myocardial damage to release detectable quantities of a marker of myocardial injury. Unstable angina is considered to be present in patients with ischemic symptoms suggestive of an ACS and no elevation in troponin, with or without ECG changes indicative of ischemia (eg, ST segment depression or transient elevation or new T wave inversion). Since an elevation in troponin may not be detectable for up to 12 hours after presentation, UA and NSTEMI are frequently indistinguishable at initial evaluation. ST

segment and/or T wave changes are often persistent in NSTEMI while, if they occur in UA, they are usually transient.

It should be kept in mind that the sensitivity of the biomarker test (usually troponin) used to evaluate patients with ACS determines whether a patient is labeled as having UA or NSTEMI. With the development of increasingly more sensitive troponins, it can be anticipated that the percent of patient with UA will decrease and the percent with NSTEMI will increase.

11.2.3 CORONARY ANGIOGRAPHY-

Coronary angiography is a procedure that uses a special dye (contrast material) and x-rays to see how blood flows through the arteries in your heart.

How the Test is Performed-Coronary angiography is often done along with cardiac catheterization. This is a procedure which measures pressures in the heart chambers.Before the test starts, you will be given a mild sedative to help you relax.

An area of your body (the arm or groin) is cleaned and numbed with a local numbing medicine (anesthetic). The cardiologist passes a thin hollow tube, called a catheter, through an artery and carefully moves it up into the heart. X-ray images help the doctor position the catheter. Once the catheter is in place, dye (contrast material) is injected into the catheter. X-ray images are taken to see how the dye moves through the artery. The dye helps highlight any blockages in blood flow.The procedure most often lasts 30 to 60 minutes.

11.2.4.PRIMARY PCI-(Balloon inflation)

Percutaneous coronary intervention (PCI), or coronary angioplasty, is a procedure carried out under local anaesthetic in which narrowing (stenosis) of the coronary arteries are dilated with a balloon catheter and are then treated with a stent (a tubular metal alloy device) which is implanted into the artery. The stent provides a permanent internal scaffold to maintain patency of the artery. In patients with a specific form of heart attack known as ST segment elevation myocardial infarction (or STEMI); the artery supplying the relevant area of heart muscle is usually completely blocked by a combination of atheroma and blood clot. Primary angioplasty (PPCI) is the use of the

PCI technique to relieve the blockage as the main or first treatment for patients suffering a heart attack. The alternative treatment for patients experiencing an ST Segment Elevation Myocardial Infarction (STEMI) is fibrinolysis: this involves the intravenous administration a clot busting drug which is injected as soon as possible after a heart attack to dissolve the blockage in the artery. Fibrinolysis, however has a number of disadvantages; around 30% of STEMI patients will have a contra- indication to fibrinolytic drugs and the drugs are successful in re-opening the blocked vessel in only around 60-70% of cases. Even if the vessel is successfully re-opened, the rate of re-occlusion, causing a further heart attack, is high.

11.2.5Cath lab-the department in a medical facility that specializes in cardiac catheterization, which is a procedure to examine blood flow to the heart and test how well the heart is pumping.

11.2.6 Door to balloon time-the amount of time between heart attack patient's arrivals at the hospital to the time he/she receives percutaneous coronary intervention (PCI)

11.2.7 Medication error

1. A medication error is any preventable event that may cause or lead to inappropriate medication use or harm to a patient.

2.A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional,patient,or consumer.such event may related to professional practice,healthcare products ,procedures,and systems,including prescribing,order communication,productlabelling,packaging,nomenclature,compounding,dispensing, distribution,administration,education,monitoring and use.(NCC MERP)

STUDY OF MODULAR OPERATION THEATRE COPMPLEX IN NEW PROJECT OF CARE HOSPITAL IN POST CONTRUCTION COMMISSIONING PHASE

Table of Contents

1. STUDY OF MODULAR OPERATION THEATRE COPMPLEX IN A MULTISPECIALITY HOSPITAL IN POST CONTRUCTION COMMISSIONING PHASE

Table of figures-

Tables-

Abbreviations list-

1.NABH-National accreditation board for hospital and healthcare providers.

2.PASU-Post anaesthetic care unit

3.ICU0intensive care unit

4.TSSU-theatre sterile supply unit

5.CSSD-central sterile supply unit

6.JCI-joint commission international accreditation

7.GFCIS-ground fault circuit interrupters

8.DU- dirty utility

9.SICU-surgical ICU

10.ELV shaft- elevator shaft

11.AHU-air handling unit

12.PUF-Poly urethane foam

13.HEPA filter-high-efficiency particulate arresting

1STUDY OF MODULAR OPERATION THEATRE COPMPLEX IN A MULTISPECIALITY HOSPITAL IN POST CONTRUCTION COMMISSIONING PHASE

1.1 Introduction

1.1.1 Background of study

An operation theatre complex is the “heart” of any major surgical hospital. An operating theatre, operating room, surgery suite or a surgery centre is a room within a hospital within which surgical and other operations are Carried out. Operating theatres were so-called in the United Kingdom because they traditionally consisted of semi-circular amphitheatres to allow students to observe the medical procedures .The patient is the centre point of a functioning OT complex. He / she is in isolation for varying times, away from his near and dear ones and is physically sick. Efforts are directed to maintain vital functions, prevent infections /promote healing with safety, comfort and economy.

The study was done in post construction commissioning phase of OT complex of New project of CARE Hospital Bhubaneswar to identify the gaps and areas of improvements before taking the handovers and simultaneously improving my understanding about the facilities of modular operation theatre complex.

OT suits are expensive and most sensitive part of the hospital after taking the handover it is difficult to correct or improve the minor issue because before starting the OT there is multiple phases of sterilisations and fumigation.

Proper OT designing and facilities are important for various accreditations of Hospital Like NABH,JCI .so it is important to undergo through study of all the aspects andstandards and compare with the facility which we are going to provide and practice.. The establishment and working of the operation theatre (O.T.) needs specialised planning and execution and is not a simple civil engineering work. A “civil-mechanical-electrical-electronic- bio medical” combo effort driven and coordinated by

the needs, preferences and safety of the medical/surgical team forms the basis for starting and maintaining an operation theatre. Anaesthesiologists, by virtue of their knowledge of the intricacies of physiology, physics and biomedical aspects of medicine and constant proximity to the operation theatre should preferably be involved from the early stages of planning of operating theatres.

On an average, operation theatres cater to 50% of the needs of total healthcare seekers. Anaesthesia-controlled time typically represents a small fraction (10–20%) of the total case time, the remainder (> 80%) being surgeon and nurse-controlled.

A great deal of intelligent planning is necessary. There must be a meeting of minds among the administrators, surgeons, anaesthesiologists surgical nurses and other concerned on important question as the number and type of operating room and the work pattern to be followed in supportive area . the architect must have had experience in designing hospital . he must have a good understanding of the complexities of the operating rooms and various management procedures and must ensure that all the questions are discussed with every group involved before reaching conclusions. The most successful surgical suits are those in which the architect has received maximum programme information from a wide cross section of all those who work in surgical suits.

1.1.2 Purpose of operation theatre complex

OT complexes are designed and built to carry out investigative, diagnostic, therapeutic and palliative procedures of varying degrees of invasiveness. Many such set ups are customized to the requirements based on size of hospital, patient turnover and may be speciality specific. The aim is to provide the maximum benefit for maximum number of patients arriving to the operation theatre. Both the present as well as future needs should be kept in mind while planning.

1.1.3 Location

The best location for the surgical department is one which permits a convenient and uncomplicated flow of patients, staff and clean supplies traffic. Surgery receives inpatient from the floor through non-public corridors, elevators and ramps. Convenient

Access to elevator is, there for essential. With regard to services, ideal adjacencies would be emergency,radiology,clinical laboratories, intensive care units, central sterile and supply department.

The separation of the surgical suit from rest of the hospital is important while planning the operating rooms .it should be so located that there will be no traffic through it and no interference from the activities of other departments

1.1.4 Different zones of OT complex

(1) **Protective zone:** It includes

- Change rooms for all medical and paramedical

Staff with conveniences

- Transfer bay for patient, material & equipment
- Rooms for administrative staff
- Stores & records
- Pre & post-operative rooms
- I.C.U. and P.A.C.U.
- Sterile stores

(2) **Clean zone:** includes administrative areas, reception-control area where personnel enter the department and patients are received and held or sent to appropriate holding areas of inner zone.

Connects protective zone to aseptic zone and has other areas also like

- Stores & cleaner room
- Equipment store room
- Maintenance workshop
- Kitchenette (pantry)
- Fire fighting device room
- Emergency exits
- Service room for staff
- Close circuit TV control area

(3) **Aseptic zone** –(inner zone) consist of actual operation rooms (sterile) and the scrub Area. Operating rooms must have a minimum clear area of 33.44 sq meter (360 sq.ft)

(4) **Disposal zone** - Disposal areas from each OR &Corridor lead to disposal zone

. **1.1.5 Sub areas (excluding OT place)**

(1) **Pre-operative check in area (reception)-** This is important with respect to maintaining privacy, for changing from street clothes to gown and to provide lockers and lavatories for staff.

(2) **Holding area-** This area is planned for IV line insertion, preparation, catheter / gastric tube insertion, connection of monitors, & shall have O2 and suction lines. Facility for CPR should be available in this area.

(3) **Induction room –** (anaesthetic room) It should have all facilities as in OT, but there is controversy as to its need. One for each OT is required ideally each is a duplicate of the other in each floor. The anaesthetic room will provide a more tranquil atmosphere to the patient than the OT. It should provide space for anaesthetic trolleys and equipment and should be located with direct access to circulation corridors and ready access to the operating room.

It will also allow cleaning, testing and storing of anaesthesia equipment.

It should contain work benches, sink. It should have sufficient power outlets and medical gas panels for testing of equipment. But in modern hospitals induction rooms are obsolete.

Post anaesthetic care units (PACU) – preferably adjacent to recovery room. These should contain a medication station, hand washing station, nurse station, storage space for stretchers, supplies and monitors/ equipment and gas, suction outlets and ventilator. Additionally 80 sq ft (7.43 sq m) for each patient bed, clearance of 5 ft (1.5 m) between beds and 4 ft (1.22m) between patient bed sides and adjacent walls should be planned.

(5) **Staff room** – Men and women change dress from street cloth to OT attire; lockers and lavatory are essential; rest room TV, etc. are desirable.

(6) **Sanitary facility for staff-** One wash basin and one western closet (WC) should be provided for 8-10 persons. Showers and their number is a matter of local decision. Inclusion of toilet facilities in changingrooms is not acceptable; they should be located in an adjacent space.

(7) **The anaesthesia gas / cylinder manifold room /storage area-** A definite area to be designated. Itshould be in a cool, clean roomthat is constructed offire resistant materials. Conductive flooring must bePresent but is not required if non inflammable gases are stored. Adequate ventilation to allow leaking gases to escape, safety labels and separate places for empty and full cylinders to be allocated.

(8) **Offices – for staff nurse and anaesthesia staff-**

The office should allow access to both unrestricted and semi-restricted areas as frequent communication with public is needed.

(9) **Rest rooms-** Pleasant and quiet rest for staff should be arranged either as one large room for all grades of staff or as separate rooms; both have merits. Comfortable chairs, one writing table, a book case etc., may be arranged.

(10) **Laboratory** – Small lab. with refrigerator for pathologist to be arranged.

(11) **Seminar room**- Since staff cannot leave an OT complex easily, it is better to have a seminar room within the OT complex. Intra-departmental discussions, teaching and training sessions for staff (with audio-visual aids) may be conducted here.

(12) **Store room**- This is designed to store large but less frequently used equipment in the OT. There should be storage space for special equipment after cleaning.

(13) **Theatre sterile supply unit (TSSU)-** Within this area, following are desirable -

i. Temperature between 180-220C, humidity of 40%-50% is the aim.

ii. Air conditioned with 10-12 air exchanges per hour

iii. Storage of sterile drapes, sponges, gloves, gowns and other items ready to use.

iv. Option to store in from one side and remove from other side .

v. Proper inventory to prevent running out of stock.

(14) **Scrub room-** This is planned to be built within the restricted area. Elbow operated or infrared sensor operated taps / water source is ideal. It is essential to have non slippery flooring in this area.

2 AIMS AND OBJECTIVE OF OF STUDY

2.1Aim-

To compare the new OT complex of CARE hospital to the criteria of ideal operation theatre and to find out the gaps in between before taking the handover from the project handling team and for taking the corrective actions.

2.2 Objective-

To improve my knowledge about the structure ,designing and facilities of modular operation theatre complex, Facilities and equipment.

3**REVIEW OFLITERATURE –**

Journal of the Academy of Hospital Administration

Operating Unit - Planning Essentials and Design Considerations

(Author(s): S.K. Gupta, S. Kant, R. Chandrashekhar)

3.1Introduction

There has been spectacular progress in the development of diagnostic facilities, improved aseptic procedures sophisticated equipment and skills in the recent past. These coupled with safer anaesthetic techniques have made surgical intervention feasible for a number of medical entities. It is imperative that operation theatre (OT) is designed scientifically to ensure sterility, easy maintenance and effective utilization.

3.2Defination

OT is that specialized facility of the hospital where lifesaving or life improving procedures are carried out on the human body by invasive methods under strict aseptic conditions in a controlled environment by specially trained personnel to promote healing and cure with maximum safety, comfort and economy. View of inside OT as shown below.

Fig.no. 3.1: An inside view of the Operating Room

3.3 Objectives of planning

The main objectives of planning should be:

- Promote high standard of asepsis.
- Ensure maximum standard of safety.
- Optimise utilization of OT and staff time.
- Optimise working conditions.
- Patient & staff comfort in terms of thermal, acoustic and lighting requirements.
- Allow flexibility.
- Facilitate coordinated services.
- Minimises maintenance.
- Ensure functional separation of spaces
- Provide soothing environment.
- Regulates flow of traffic.

3.4 Principles of designing

The essential principles that should be followed in planning the physical layout of operating room suite are exclusion of contamination from outside the suite with proper traffic patterns within the suite and separation of clean areas from contaminated areas within the suite.

OTs require specialized planning because surgical facilities represent a central lifesaving activity, they make or break the reputation of the hospital, depending on their functional efficiency, it is a major cost center in the establishment of the hospital, are responsible for an appreciable quantum of revenue in private sector and no one plan suits all hospitals. A scientific and detailed planning is required while designing an OT in order to ensure its smooth functioning, efficiency and effective utilization. A schematic diagram of OT service is shown in Fig. 1.

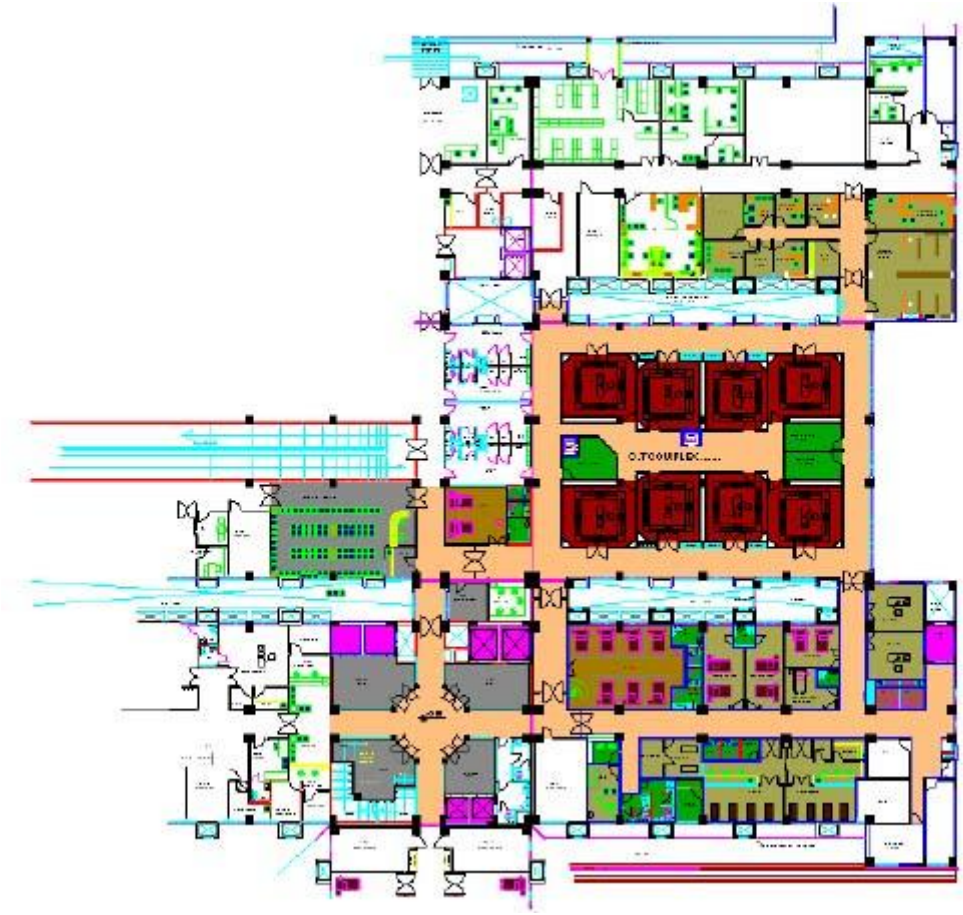

Fig.3.2: A Schematic Diagram of OT Services

Fig.no. 3.3: Inside of an OT

Fig.no 3.4: Corridors of OT

Fig.no 3.5: Hermetically Sealed Door **Fig.no 3.6: Sliding Doors**

3.5Design parameters

OT should be planned so as to ensure:

- Avoidance of unrelated hospital traffic flow in the area.
- Convenient functional relationship and communication with surgical ward, ICU, CSSD, blood bank, medical imaging and laboratory services.
- Avoidance of outdoor source of noise.
- Provision for future expansion/alterations.
- If planning for Modular Theatre, the walls should be galvanised iron / Stainless steel panels, joints filled with epoxy and grinded. The final prepared surface is treated with anti bacterial paint.
- Doors should be of sliding type of minimum 1.2 m width in areas where patient movement is anticipated like operation theatre, pre and post operative rooms. The sliding doors are preferred to the double action leaf type since they are more user friendly, saves space and prevents air turbulences. Ideally doors should be electrically operated hermetically sealed sliding doors to ensure sterilization and correct air pressure. The main advantages of a hermetically sealed sliding door (Plate 4) are: that disinfections is quicker and safer, contamination risks are under control, acoustic and noise control is easier and In case of failure of air handling unit temperature and humidity levels are brought within range more quickly.
- Corridors should not be less than 2.85 m. in width to facilitate movement of trolleys and stretchers.

- Walls and ceiling should be aesthetically pleasing nonporous, fire resistant, water and stain proof, seamless, non-reflective and easy to clean. They should not cause build-up of a static electrical charge. They should be joint less or have joints capable of being sealed.

Fig.no.3.7: Modular Theatre Walls

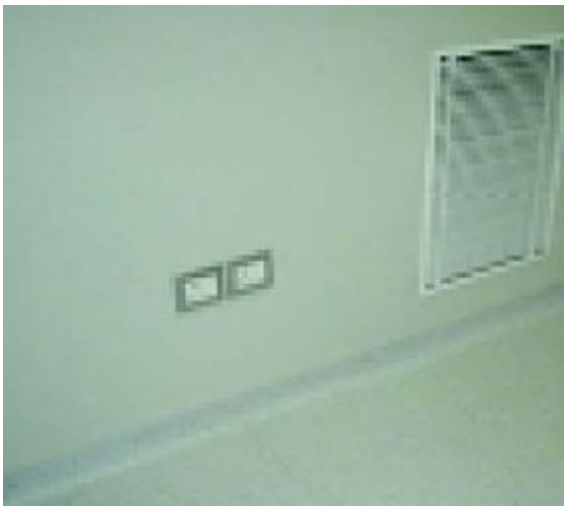

Fig.no 3.8: Coved Corners

Fig.no 3.9: Surgical sinks with electronical sensors

Fig.no 3.10: Flash Autoclave

Floors should be smooth, non-slip, impervious material conductive enough to dissipate static electricity but not conductive enough to endanger personnel from shock. The flooring should either be inset mosaic with least possible joints and copper strips to carry away any static electricity produced or of joint less conductive tiles. Conductive copper mesh and self-levelling epoxy flooring may be done.

- Ceiling should be painted with washable paint and corners of the rooms should be rounded off to prevent collection of dirt and dust.
- Taps in the scrub room should be knee/elbow operated or preferably electronically controlled taps activated by infrared sensor.
- Power back up with provision of stand-by generating sets.
- Certain facilities may be shared with the obstetric/birthing unit. However it must be ensured that when service areas are shared with delivery rooms they should be designed to avoid movement of patients/staff between the operating room and delivery room areas.
- In operating rooms anaesthetic room(s) recovery room, holding area, colour of walls and ceilings should be such that they do not alter the observers perception of skin colour this will facilitate patient monitoring and management.
- OT should have facilities for high speed autoclaves/ sterilizers for immediate/emergency requirements of sterilizing equipment.
- Essential pharmaceutical storage including refrigeration facilities should be available.
- There should be a waiting room with toilet facilities for patient attendants.
- Pass-through cabinets that circulate clean air through them while maintaining positive air room pressure allow transfer of supplies from outside the OR to inside it. They help ensure the rotation of supplies in storage or can be used only for passing supplies as needed from a clean center core.
- There should be X-ray film illuminators preferably recessed into the wall.
- There should be emergency communication system that can be activated without the use of hands. Preoperative Patient Holding Area: This should be able to facilitate stretcher as well as ambulatory patients not requiring stretchers. Each stretcher station should be of 80 sq. feet (7.43 sqm) and should have a clearance of 4 feet (1.22m) on the sides of the stretcher and foot of the stretcher. Post Anaesthetic Care Units : These Should contain a medication station, hand washing station, nurse station, Storage space for stretchers, supplies and equipment. Additionally 80 sq feet (7.43 sqm) for each patient bed clearance of 5 feet (1.5 m) between bed and 4 feet should be (1.22m) between patient bed sides and adjacent walls.

Fig.no 3.11: X-Ray View Box

Fig.no 3.12: Pass Through Door

Fig.no3.13: Control Panel

Fig.no 3.14: Post Anaesthetic Care Unit

Service Area: These should include control station located to permit patient observation of all units in to the suite.

A sub sterile area between two or more operating areas for flash sterilizer, sterile supply storage area and hand washing station.

- Scrub facilities near the entrance of each operating room.
- Dirty utility for collection and disposal of soiled material.
- Clean supply room

- Operation room
- Medical gas storage facilities.
- Anaesthesia workroom for cleaning, testing and storing anaesthesia equipment.

3.6Staff Amenities: Separate areas should be provided for male and female personnel containing lockers showers , toilets, lavatories and space for donning surgical attire should allow one way traffic i.e. personnel entering from outside the surgical suite to change and move inside.

3.7Medical gases: The main storage of medical gases should be outside the facility and there should be provision for additional separate storage of reserve gas cylinders for a minimum of one day requirement.

3.8Anaesthetic Work room: It should provide space for anaesthetic trolleys and equipment and should be located with direct access to circulation corridors and ready access to the operating room. It is to provide cleaning, testing and storing of anaesthesia equipment. It should contain work benches, Sink(s) and racks for cylinder It should have sufficient power outlets and medical gas panels for testing of equipment.

Fig.no 3.15 : Scrub Facility

Fig.no 3.16: Nurses Duty Room

Fig.no3.17: Sluice (Dirty Utility)

Fig.no3.18: Change Room

3.9Blood Store: There should be provision for refrigerated blood storage. The storage refrigerator may be in a dedicated or shared space.

3.10 Set up Room: It is the clean workroom where clean/sterile materials are held and arranged prior to use in the operating room. Its functions include storage of instruments and materials, holding of sterile supplies and packs, preparation of dressing and instrument trolley, storage of drugs and where theatre sterile supply unit service is not available flash sterilization of dropped or specialized instruments. It should be so located that it has direct access to operating rooms and Central Supply/Theatre Sterile Supply Unit. Positive pressured to be maintained relative to adjoining rooms.

3.11 Laboratory: An area for preparation and examination of frozen section may be provided. Depending on the operational policy this may be part of the main laboratory.

3.12 Storage: For equipment and supplies utilized in the operating unit adequate store rooms should be provided. The design should allow ease of access to the storage areas for delivery of consumables. Controlled access from an external corridor is recommended. Store rooms are best designed in an elongated rectangular shape to allow easy access to all items. Part of the room may be utilized as an area for testing operating equipment. For this purpose a separate room called as Bio medical Engineering room may also be planned. Storage bays preferably recessed into the corridor walls should be provided for equipment such as stretchers and portable x-ray.

3.13ZONING

Zones are area of varying degrees of cleanliness in which the bacteriological count progressively diminishes from the outer to the inner zones (operating area) and is maintained by a differential decreasing positive pressure ventilation gradient from the inner zone to the outer zone. They are of following types.

3.13.1 Protective Zone: Areas included in this zone are:

- Reception
- Waiting area
- Trolley bay
- Changing room

3.13.2Clean Zone: Areas included in this zone are:

- Pre-op room
- Recovery room
- Plaster room
- Staff room
- Store

3.13.3Sterile Zone: Areas included in this zone are:

- Operating Suite
- Scrub Room
- Anaesthesia Induction Room
- Set up Room

3.13.4Disposal Zone: Areas included in this zone are:

- Dirty Utility
- Disposal corridor

Fig.no3.19: Recovery Room

Fig.no3.20: Sterile Supply

Fig.no 3.21: Induction Room

3.14 Ventilation: Central air conditioning should ensure temperature range of 18-24o centigrade with 50-60 humidity levels. A minimum of 20 air changes/hour should be ensured. It is preferred to have 100% fresh air. Theatre to maintain positive pressure, and controlling of pressure is adhered to by providing pressure Release Dampers at the time of opening & closing of the door. The minimum bacteriological Requirements are that the air should not contain detectable clostridium spores of coagulase positive staphylococcus. Aerobic cultures on non-selective medium should indicate not more than 35 bacteria-carrying particles in 1 m3 of ventilating air. During surgical operations the concentration of bacterially - contaminated airborne particles in the operating theatre averaged over any 5 minute period should not exceed 180 per m3 (5 per ft 3), and special types of surgical operation, e.g., orthopaedic and transplantation procedures, higher standards of air cleanliness must be ensured.

3.15 Lighting: General illumination is furnished by ceiling lights. Lighting should be evenly distributed throughout the room. around 300 lux the anaesthesiologist must have sufficient light, to adequately evaluate the patient's skin colour. Electrical wiring should be in concealed conduit lighting both natural and artificial should be of appropriate illumination.Isolated power systems help prevent sparks from igniting flammables anaesthetics and also help to protect patients and personnel from shock. Ground fault circuit interrupters (GFCIS) may be utilized which are designed to shut off the electric power within a few milliseconds of the occurrence of a ground fault, thereby preventing serious electric shock.

To minimize eye fatigue, the ratio of intensity of general room lighting to that at the surgical site should not exceed 1:5, preferably 1:3. This contrast should be maintained in corridors and scrub areas, as well as in the room itself, so that the surgeon becomes accustomed to the light before entering the sterile field. Colour and hue of the lights also should be consistent. The overhead operating light must.

- Make an intense light, within a range of 27,000 to 127,000 lux, into the incision without glare on the surface. The light may be equipped with an intensity control.
- Provide a diameter light pattern and focus appropriate for size of the incision. Fixture should provide focused depth by refracting light to illuminate both the body cavity and the general operating field.

Fig.no3.22: Pressure Release Damper

Fig.no3.23: OT Light

Fig.no 3. 24: Inside of an Operation Theatre

- Be shadow less. Multiple light sources and/or reflectors decrease shadows.
- Produce the blue-white colour of daylight.
- Be freely adjustable to any position or angle by either a vertical or horizontal range of motion.
- Should enable easy cleaning.
- Should be aerodynamically designed to facilitate airflow.
- Produce a minimum of heat. Halogen bulbs generate less heat than other types.

3.16Auditory Effects: Sound level in OT should be limited to 25-35 db. The reverberation time in OR should be reduced to below one second.

3.17Fire Safety: Both ionization and optical fire detectors should be provided in the operation theatres as against heat detectors, since equipment - oriented operation theatres are likely to create more smoke than heat in the eventuality of fire. Hydrants and fire extinguishers should be provided. Fire exist route should be clearly identified, earmarked and well illuminated.

3.18Water Supply: Besides normal supply of available water at the rate of 400 litres per bed per day separate reserve emergency overhead tank should be provided for operation theatre.

3.19Modular Systems: Modular systems are available which consist of prefabricated units for operating suites complete with integrated mechanical and electrical services including air-conditioning.

Fig.no 3. 25: Inside of an Modular Operation Theatre

3.20 Integrated Operating Room: In a integrated OR technology, it is possible to control everything from medical devices, lighting cameras and teleconferencing from a central station, which may be inside or outside the sterile area. A schematic linkage diagram of a integrated operation room is shown in Fig. 2.

3.21 Conclusion: The operative unit provides a controlled climatic environment for the operative and pre-operative care of patients undergoing diagnostic and surgical procedures under anaesthesia. Surgical practices in the past were not as sophisticated as in the present. The introduction of safer practices in anaesthesia, surgical advances, integration of computerization system including robotic surgery has necessitated the modernization of operation theatres. The design of an operating theatre offers a challenge to the planning team to optimize efficiency by creating conclusive environment conditions, realistic functional traffic flow, and flexibility for future expansion.

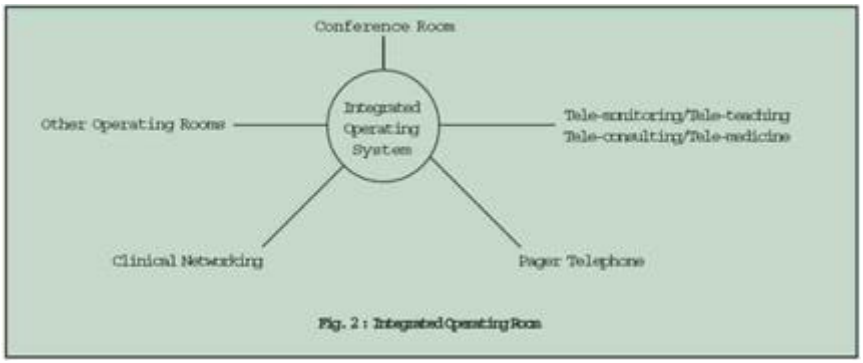

Fig. 2 : Integrated Operating Room

Table 3.1: Recommended Schedule of Accomodation

Room/Space	**Area (sq m)**	**Remarks**
Reception	10	many may be required depending on size of hospital
Anaesthetic Induction Room	15	-do-
Operating Room (major)	42-50	-do-
Scrub up/gowning	6	may be co-located between operating rooms
Support Areas		
Anaesthetic room	10-15	many may be required depending on size of hospital
Mobile Equipment bay	4	many may be required depending on size of hospital
Bay Linen	3	-do-

Cleaners room	4	-do-
Clean up room	10	-do-
Disposal room	8	-do-
Flash sterilizing	5-6	-do-
Laboratory/Frozen section	4-12	-do-(Optional)
Set up Room	20	-do-
Store Anaesthetic	20	-do-
Store Equipment	20-40	depending on size of hospital
Store Sterile	20-80	
Store Non sterile	20-30	
Blood Store	4	
Recovery Area		
Bay Patient	9	many may be required depending on size of hospital
Bay Linen	3	generally 2 bays for patient per operating room
Bay Resuscitation trolley	2	
Bay Hand washing	1	-do-

Clean utility	12	
Dirty utility	10	
Staff station	6-14	depending on size of hospital
Administrative Staff and Shared Areas		
Area/Space	**Area in sq.m**	**Remarks**
Change room	10-30	Many may be required depending on type and size of hospital
Office single person	9	-do-
Store	10	-do-
Toilet staff	2	-do-
Shower staff	2	-do-
Staff lounge	10-30	Depending on size of hospital and staffing establishment
Shared Areas Meeting Room	20-30	
Store general	9	
Waiting	4	
Circulation areas of 40% should be catered.		

4 Methodology

4.1Research questions-

1. What are the gaps and areas which can be improved before taking the handover from project team in OT complex?

2. Does the OT complex fulfil the criteria of standard guidelines?

3.what are the facilities which are provided in OT complex?

4.2Study area- OT complex of NEW CARE hospital Bhubaneswar

4.3Study design- Qualitative,Descriptive study

4.4Approach- the approach of this project was-

- Daily visited the site.
- Self-observation of the process which were going in the OT complex.
- Semi structured interview of project persons for clearing my doubts(maintenance head, biomedical engineer, architects and other project handling persons)
- Involving in the daily discussions of the authorities who came there for visiting Like the operation managers, quality managers, doctors and senior ot nurses and other members who are involved in planning.

1. **Primary source of data-**

- Self-observation of process which are going on at site of new CARE hospital.
- Involvement in Daily discussions with project members.

2. **Secondary source of data-**

- Available literature on OT planning.

4.5 Instruments and tool used for study-

1. Qualitative data collection by interviews and open ended questions of different authorities to know their opinion regarding the OT complex.

2. Focus group discussions of project planning persons used as a tool of study.

3. Direct observation.

5 CARE Hospital new project-

5.1 Phases of hospital planning

Step 1-project conceptualization-this is a preliminary stage where one is trying to visualize his hospital in terms of its ownership, philosophy, bed mix, facility-mix.

Step-2-feasibility analysis-when the project concept is understood, agreed on and locked in ,the next stage is to understand the viability of the proposed hospital and detailed working of at least the following.

-Project cost-comprising of civil work, medical equipment, furniture and fixtures professional fees interest during constructions, pre-operative expenses and contingencies expense appropriations

-Sensitivity analysis-this is most important document generated for the project and helps to promoter to undertake a "go or no go" decision.

Step-3-Hospital design-hospitals are highly engineered building so this step required a meticulous attention to micro detail for this reason alone its vital that one hires a competent team of designers which would include a architect ,structural consultant, a electrical consultant ,a plumbing consultant, a interior and designer consultant and landscape consultant etc.

Step-4 project management-the notion is that architect is automatically a good project manager is myth even from a layman's angle, it should not be very difficult to understand that the architecture should effortlessly accommodate the complexities of engineering services and the installation of very sophisticated, very costly medical equipment-apart from the various financial and speed of work related issue involve in project execution.

Step-5-commissioning of hospital-the last but not least step of hospital project is to ready it for accepting patient and starting all operation this process should begin at least 6-9 month prior to inauguration as there are a plethora of activities to be completed before the patient walk in, issue like developing personal policy, salary structure, sops for all department selecting and customising hospital information system, recruitment ,trial runs of equipment, stationary, designs, etc. CARE hospital is in 5^{th} stage ,

5.2 The planning committee of new project (CARE hospital)

1.)Kasi Raju(groups COO & head of the project)

2.)Dr. Shrinivas Iyenger (project consultant

3.)Mr. Kalmakar (Sr. VP project)

4.)Ravindra G (VP project)

5.)Dr. Rahul Medakar (GM operations)

5.3 Designing proposal layout before construction-

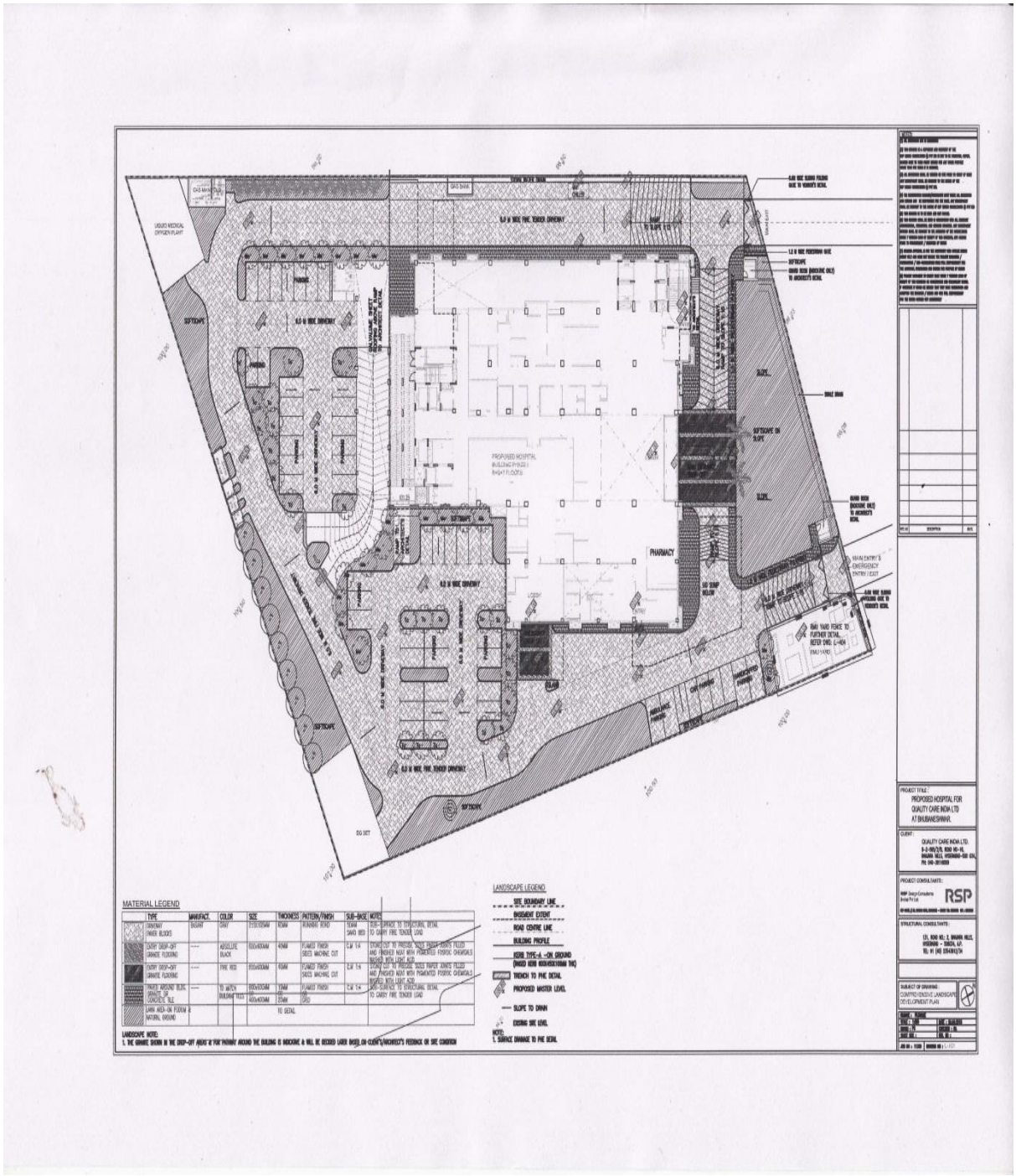

Fig.no.5.1 proposed layout of CARE hospital before construction

5.4 Third floor layout where the OT complex is situated-

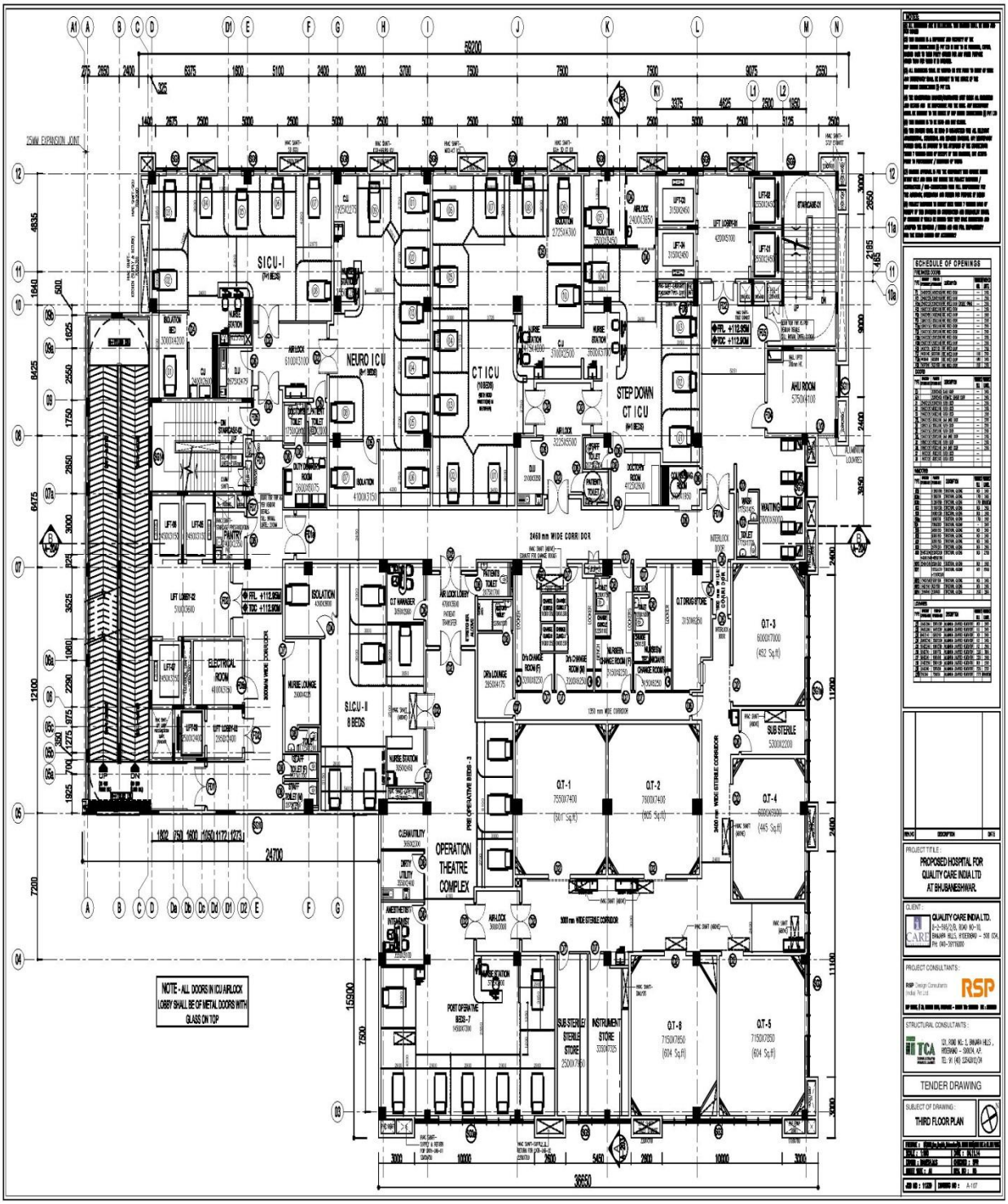

Fig.no.5.2 OT complex layout

6 CARE HOSPITAL OPERATION THEATRE COMPLEX

6.1 Location –OT complex is situated on 3rd floor and different post op ICU are also situated

6.2Facilities

1 OT complex

1.)OT manager room

2.)Pre-operative area(3 bedded)

3.)Clean utility

4.) Dirty utility

5.) Post-operative area(7 bedded)

6.)Nursing station

7.)3000 mm wide sterile corridor

8.)OT 1

9.)OT 2

10.)OT 3

11.)OT 4

12.)OT 5

14.)OT 6

15)Sterile store

16.)Instrument store

17.)OT Drug store

18.)1500 MM Wide corridor

19.)1500 MM Wide corridor

20.)1400 MM wide corridor

21.)Nurse/technician change room (male)- change cubicals-2 rooms with toilets

22.) Nurse/technician change room (female)-change cubical--2 rooms with toilets

23.)Doctors change room (male)- change cubical -2 rooms with toilets

24.)Doctors change room (female)- change cubical -2 rooms with toilets

25.) Doctors lounge

26.) Doctors toilet

2 Surgical ICU-

1.) SICU (5+1) 5 beds, 1 isolation bed with toilets

2.) Nursing station (SICU)

3.) Staff toilet (male)

4.) Staff toilet (female)

5.) Nurses lounge

6.) Toilet

7.) 2450 mm wide corridor

8.) 3200 mm wide corridor

3.NEURO ICU-

1.) 8+1 Bed (isolation bed)

2.) Nurse station

3.) Clean utility

4.) Dirty utility

5.) Patient toilet

4. CT ICU-

1.) Beds (1 isolation bed)

2.) Nursing station

3.) Clean utility

5.STEP DOWN CT ICU-

1.) 4+1 beds (Isolation room)

2.) Nurse station

3.) Clean utility

4.) Staircase -01

Other facilities

1.) F.H.R-1 Shaft

2.) Lift lobby-01

3.) Lift lobby-01

4.) Lift lobby-01

5.) ELV shaft

6.) Staircase-02

7.) F.H.R-2

8.) Ramp

9.) Electric room

10.) Pantry

11.) Duty doctor room with toilet

12.) Counselling room

13.) Doctors rooms

14.) Waiting

15.) AHU Room

7 OT ROOMS

7.1 ANTISTATIC FLOORING-

Vinyl floor covering is ideal for many applications in the healthcare sector calling for hygienic, easy care solution. Our wide selection of high quality Smooth, seamless, solid strength, cleanliness and hygiene with defiant durability.

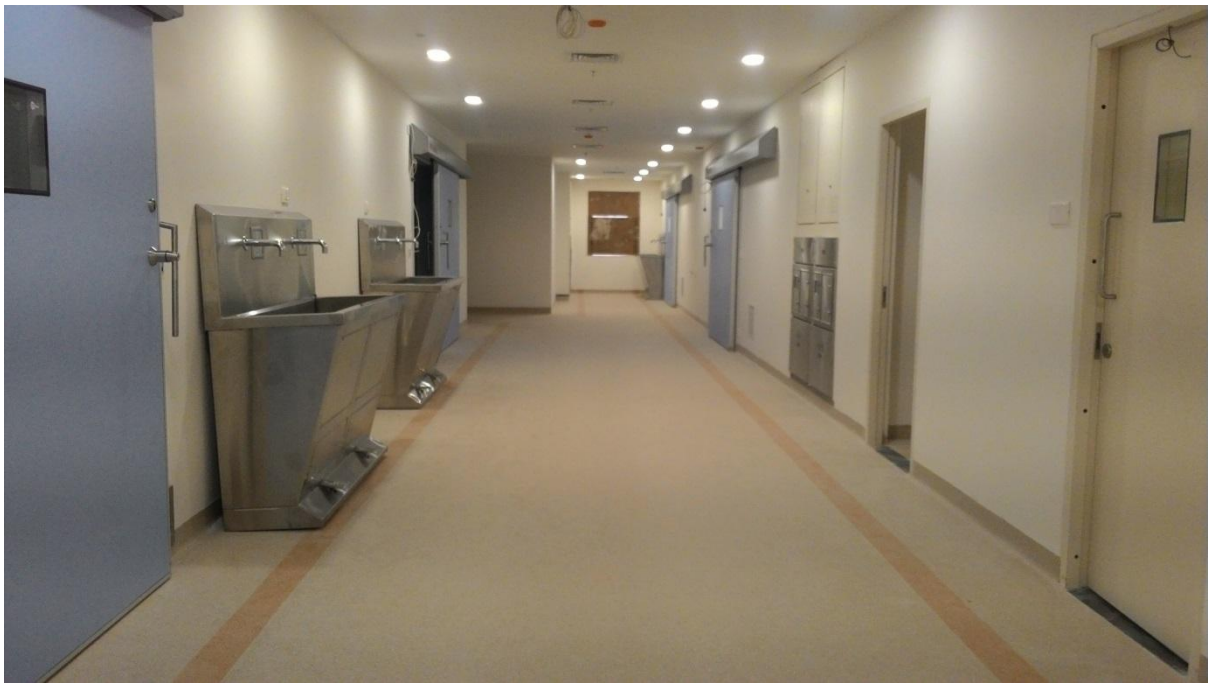

Fig.no.7.1 OT complex of NEW CARE hospital Bhubaneswar

7.2 WALL- GI PUF PENAL WITH PU COAT

Sandwich panels made by 1 mm GI sheet in front and 0.8 mm GI sheet on back with PUF (POLY URETHANE FOAM) filled in between two sheets are fitted on wall. Panels have interlocking arrangement. Joints are filled with metallic putty. Complete structure is spray painted with PU paint. At completion walls looks one piece without any joint or groove.

7.3 Ceiling-

7.3.1**Peripheral lights**

Luminaires for cleanrooms with increased hygienic requirements for 4 or 2 fluorescent Lamps, integrated with ceiling panels system. Luminaire cover of highly resistant laminated safety glass, frosted or transparent. Luminaire body of galvanised sheet steel, powder-coated. Protection rating IP65, safety class I, with electronic ballast

Fig.no.7.2 peripheral lights

7.3.2Laminar Ceiling Air Diffusers

The laminar ceiling air diffusers also known as laminar ceilings are to be used for air conditioning of operating theatres and clean rooms. The devices are equipped with absolute H 13 filters with 99,95% filtration efficiency.

Fig.no.7.3 laminar air diffuser

7.4Hermetically sliding Door-

Hermetically sealing maintain quick positive pressure required inside the OT. These door prevents air-turbulence which ensure required sterile. Doors are sensor based. Foot sensor is placed for automatic opening.

Fig.no.7.4 sensor controlled sliding door

7.5 Operation theatre control penal-

Surgical control panels or operating room control panels are the central focus for infrastructure controls as well as alarms and information required in an operating room.

Main benefit of this focus is that-

It allows the users to only have one familiar source on information and lets the facilities staff easily inspect and maintain several different subsystems, without disrupting the wall infection integrity.

The penal includes

-Time day clock

-Time elapse clock

-General lighting system

-Medical gas alarm penal

-Temperature,humidity control

-Hand free telephone set

-Heap filter status

-Room pressure indicator

Fig.no.7.5 surgeons control penal

7.6 x-ray viewer-

Digital x-ray viewing screens is made up high quality opaque acrylic sheet and electrolysed steel with powder coated material that displays a magnified image.

LED double x-ray viewer is placed in OTs.

Fig.no.7.6 x-ray viewer

7.7 Pendants

The clinical pendants ensures safe and organized treatment environment for patient and staff, reducing any possible hazards in the operation theatre room.

Multimovement pendants are placed in OTS .

These are ceiling mounted pendants that offer unparalleled flexibility for management of patient environments and and clinical workspace. The pendant arms and heads can be rotated to almost any position providing all round access to the patient and easily and safely repositioned to suit different cases and procedures.

Fig no.7.7 pendants

7.8 Scrub sinks

Double bay station sink which are made of stainless steel and it is sensor based for better infection control.

Fig.no.7.8 scrub sink sensor based

7.9.OT Table

-Engineered for increasingly complex surgical cases.

-Decompression mattress for the comfort of the patient to remove the incidence of -- Decubitus ulcer with an antistatic, waterproof, and seamless design.

-High level weight capacity in normal and reverse position.

-Electric break system for optimum stability.

-Return to original position with one button.

7.10 Air handling unit-

AHU FOR OT OMPLEX-	1
MADE BY-	ZECO
MODEL NO.-	ZDS
CAPACITY-	3100CFM
TYPE-	DOUBLE SCREENAHU

Table no.- 7.1 AHU in CARE hospital OT complex

Fig.no.-7.9 AHU

Components of AHU-

Blower/Fan-

Air Handling Unit typically employs a large squirrel cage blower driven by an AC induction electric motor to move the air. The blower may operate at a single speed, offer a variety of set speeds, or be driven by a VFD to allow a wide range of air flow rates. Multiple blowers may be present in large commercial air handling units, typically placed at the end of the AHU and the beginning of the supply ductwork (therefore also called "supply fans"). They are often augmented by fans in the return air duct ("return

fans") pushing the air into the AHU.

Heating and/or cooling elements

Air handling units may need to provide heating, cooling, or both to change the supply air temperature depending on the location and the application.
Large commercial air handling units contain coils that circulate hot water or steam forHeating, and chilled water for cooling. Coils are typically manufactured from copper for the tubes, with copper or aluminium fins to aid heat transfer. Cooling coils will also employ eliminator plates to remove and drain condensate.

Filters

Air Filtration is almost always present in order to provide clean dust-free air to the building occupants. It may be via simple Pre filter media, Fine or HEPA, or a combination of techniques. Gas-phase and ultraviolet air treatments may be employed as well.It is typically placed first in the AHU in order to keep all its components clean. Depending upon the grade of filtration required, typically filters will be arranged in two (or more) banks with a coarse-grade panel filter provided in front of a fine-grade bag filter, or other 'final' filtration medium. The panel filter is cheaper to replace and maintain, and thus protects the more expensive bag filters.

Mixing chamber

In order to maintain indoor air quality, air handling units commonly have provisions to allow the introduction of outside air into, and the exhausting of air from the building. In temperate climates, mixing the right amount of cooler outside air with warmer return air can be used to approach the desired supply air temperature. A mixing chamber is therefore used which has dampers controlling the ratio between the return, outside, and exhaust air.

Vibration Isolators

The blowers in an AHU can create substantial vibration and the large area of the duct system would transmit this noise and vibration to the occupants of the building. To avoid this, vibration isolators (flexible sections) are normally inserted into the duct immediately before and after the AHU and often also between the fan compartment and the rest of the AHU. The rubberized canvas-like material of these sections allows the AHU to vibrate without transmitting much vibration to the attached ducts.
The fan compartment is further isolated by placing it on a spring suspension,which will mitigate the transfer of vibration through the floor.

Air Scrubbers

Air Scrubber is often necessary in colder climates where continuous heating will Make the air drier, resulting in uncomfortable air quality and increased static Electricity. Various types of humidification that may be used are:

Evaporative: dry air blown over a reservoir will evaporate some of the water. The rate of evaporation can be increased by spraying the water onto baffles in the air stream.

Vaporizer: steam or vapour from a boiler is blown directly into the air stream.

Spray mist: water is diffused either by a nozzle or other mechanical means into fine droplets and carried by the air.

A tray of fresh water in the airstream is excited by an ultrasonic device forming a fog or water mist

Wetted medium: A fine fibrous medium in the airstream is kept moist with fresh water from a header pipe with a series of small outlets. As the air passes through the medium it entrains the water in fine droplets. This type of humidifier can quickly clog if the primary air filtration is not maintained in good order.

Heat Recovery Unit

A heat recovery device may be fitted to the air handler between supply and extract air Streams for energy savings and increasing capacity. These types more commonly Include for:

Recuperator or Plate Heat Exchanger: A sandwich of plastic or metal plates with interlaced air paths. Heat is transferred between airstreams from one side of the plate to the other. The plates are typically spaced at 4 to 6mm apart. Can also be used to recover cool. Heat recovery efficiency up to 70%.Thermal Wheel or Rotary Heat Exchanger: A slowly rotating matrix of finely corrugated metal, operating in both opposing airstreams. When the air handling unit is in heating mode, heat is absorbed as air passes through the matrix in the exhaust airstream, during the first half rotation, and released duringthe second half rotation into the supply airstream in a continuous process.

When the air handling unit is in cooling mode, heat is released as air passes through the matrix in the exhaust airstream, during the first half rotation, and absorbed during the second half rotation into the supply airstream. Heat recovery efficiencyisup to

85%. Wheels are also available with a hydrophilic coating to provide latent heat transfer and also the dryingor humidification of airstreams.

Heat Pipe: Operating in both opposing air paths, using a confined refrigerant as a heat transfer medium. The 'pipe' is multiple sealed pipes mounted in a coil configuration with fins to increase heat transfer. Heat is absorbed on one side of the pipe, by evaporation of the refrigerant, and released at the other side, by condensation of the refrigerant. Condensed refrigerant flows by gravity to the first side of the pipe to repeat the process. Heat recovery efficiency is up to 65%.

7.11 Hepa filters and laminar air flow-

Laminar air flow ventilation is used in operation theatre to reduce the number of infective organism which present in air ,to keep air clean of dust,fungus,micro-organism.

Equipment name	Plenum Hepa filter
Made by	Spectrum
Efficiency Quantity	0.3 micron 8 in each OT
Type	Laminar air flow

Table no.7.2hepa filter in OT

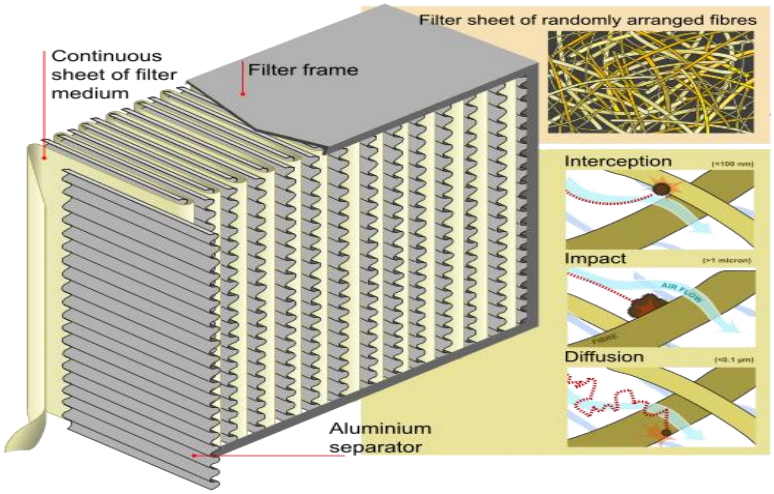

Fig.no.7.10 functioning of heap filter

HEPA filters are composed of a mat of randomly arranged fibres. [4]The fibres are typically composed of fiberglass and possess diameters between 0.5 and 2.0micrometers. Key factors affecting its functions are fibre diameter, filter thickness, and face velocity. The air space between HEPA filter fibres is typically much greater than 0.3 μm. The

common assumption that a HEPA filter acts like a sieve where particles smaller than the largest opening can pass through is incorrect and impractical. Unlike membrane filters at this pore size, where particles as wide as the largest opening or distance between fibres cannot pass in between them at all, HEPA filters are designed to target much smaller pollutants and particles. These particles are trapped (they stick to a fibre) through a combination of the following three mechanisms:

Interception :

Where particles following a line of flow in the air stream come with inone radius of a fibres and adhere to it.

Impaction:

Where larger particle are unable to avoide fibres by following the courving contours of the air stream and are forced to embed in one of them directly,this effect increases with diminishing fibre separation and higher air flow velocity.

Diffusion

An enhancing mechanism that is a result of the collision with gas molecules

By the smallest particles, especially those below 0.1micro meter in diameter which are there by impeded and delayed in their path through the filter.

Fig.no.7.11 Hepa filters in CARE OT.

7.12 Uninterruptable power supply(UPS)

UPS are a critical part of a hospitals power supply infrastructure when coupled with IPS and backup generators, they provide the operating room and other critical care with continuity of powerIn the event of variety of supply failure scenario.

Equipment name	UPS
Made by	Consul Neowatt
Model no.	FALCAN 5000
Capacity	120KVA
Quantity	2
Type	On line UPS
Back up	30 min.

Table no.7.3 UPS information

Fig.no.7.12 UPS

7.13 Chiller plant-

NEW CARE project is a green project so her bluestar chiller system is placed for centralised cooling which is eco-friendly as well as energy saver which is situated in basement having following features

Efficient compressor-

The reliable semi hermetic screw compressors are tested in accordance with ARI standards And are quite in operation, efficient and maintenance-friendly. These compressors have the latest patented profile design, with separate radial and axial force bearing,PTC motor winding protection ,discharge temperature protection with its controller, oil level and oil differential pressure switched. This guarantees reliability and long life of bearing even after running for over 1 lakh hours under heavy operating conditions.

Falling film evaporator-

It helps in significantly reducing refrigerant charge, making it green by design(extremely eco-friendly).it also improves the heat exchange efficiency by maintaining a higher

evaporationtemperature. Higher the evaporation temperature of the system, greater the cooling capacity of the unit.

Fig.no.7.13 compressor

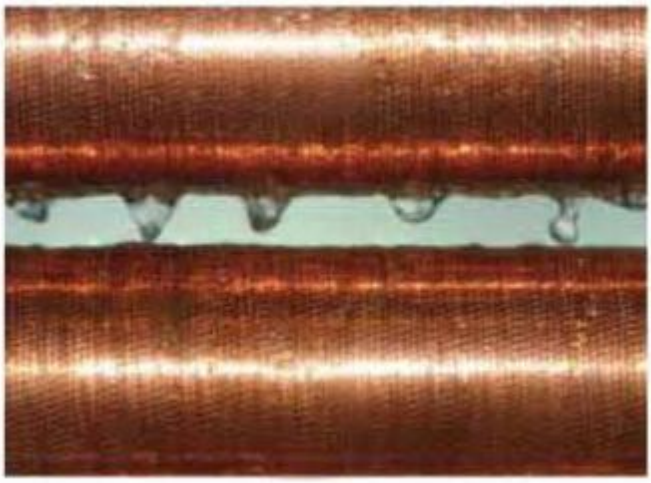

Fig.no.7.14

Micro controller

The control panel specially designed for this chiller framework.the microcontroller s part and its power section are separated in the control panel foe ease of installation and servicing. The microprocessor control panel helps on controlling various chiller operating parameters accurately.

servicing. The microprocessor control panel helps on controlling various chillier operating parameters accurately.

Fig.no.7.15 microprocessor controlpanel

Superior mechanical design enhance energy saving

Refrigerant return

By using a mechanical design, the liquid refrigerant from the bottom of the evaporator (not fully evaporated)is returned and distributed from the top again without the use of any external electrical energy. And because the evaporating temperature is higher, it conserves much energy.

Oil return

The mechanical design of the eject pump completes the oil return process without any additional power, by using a unique inner structure.it is also very reliable since it doesn't have any mechanical moving parts.it has no transmission part, so there are no maintenance failure.

Fig.no 7.16.Efficient flash-type economiser

By using the unique economiser, the medium-pressure flash gas and liquid refrigerant are separated efficiently. The medium pressure flash gas is sent back into the side port of the compressor for the second stage of compression. The saturated liquid refrigerant, now separated, exchanges heat with the low temperature oil-rich refrigerant, extracted from the bottom of the evaporator. This cools the liquid refrigerant, increasing unit efficiency.

7.14 OTHER SUPPORTING FASCILITIES

7.14.1 diesel generator

Made by	Sterling
Model	SGP750PR
Rating	750 kva
Voltage	415 volts
Frequency	50 Hz
Speed	1500 RPM
Engine model	Perkin 4006D23TAG2
Displacement	22.92 L
BORE	160mm
Stroke	190mm
BHP	895
Type	Brushless sync.generator

Table.no.7.4 DG installation

Fig.no.7.17 DG

7.14.2 Reversr Osmosis PLANT-

Situated on 4th floor.

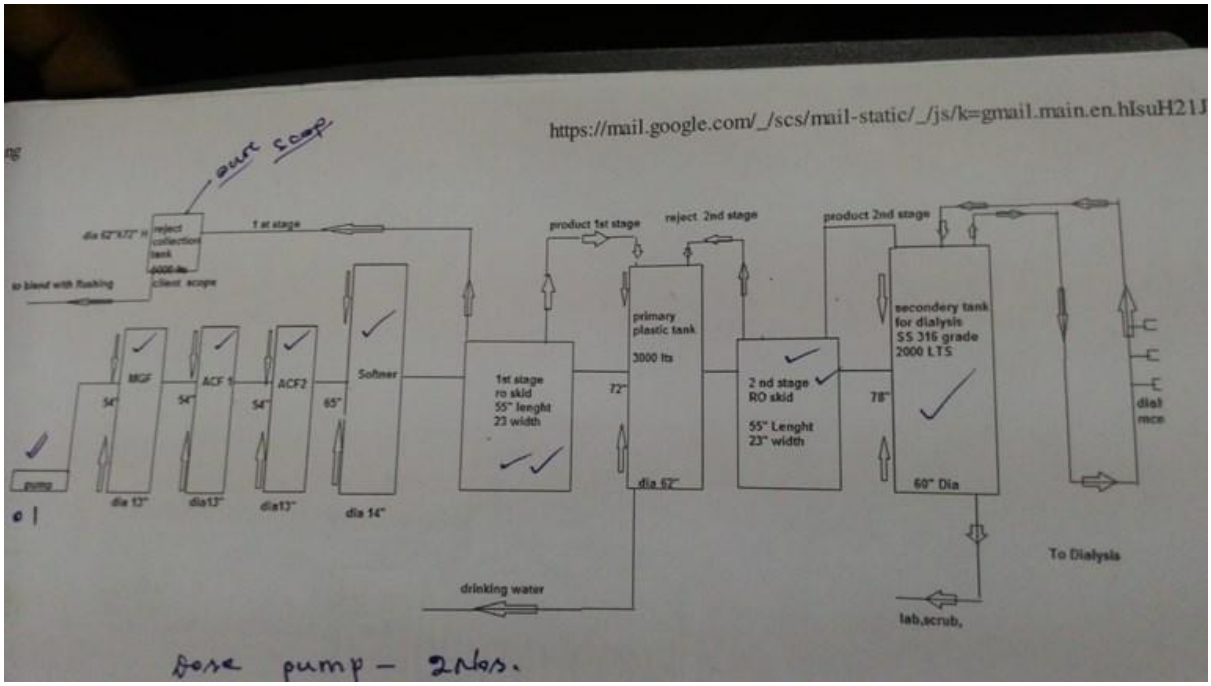

Fig.no.7.18 RO plant layout

7.14.3 Transformer-

Equipment	Transformer
Made by	Kiroskar
Efficiency	1500KVA
Quantity	1
Type	ONAN cooling

Table no.7.5 transformer installation

7.14.4lifts-lifts are important part for patient flow in vertical hospitals.

Equipment	Lift
Made by	Thyssenkrupp
Capacity	26 person
Model no	YTTD180TUP4-4
Quantity	4
Type	All are Stretcher lift

Table no.7.6 lifts in CARE hospital

7.14.5 Alarm for Medical gas pipeline system-

Gas alarm with monitors which displays the current status of central medical gases supply and vacuum system and trigger dual alarm in case of any deviation from the predetermined set parameters.theses alarm alert the user with an auditory and visual alarm for MGPS which is located in OT complex.

Fig.no.7.19emergency gas alarm

7.14.5 6 Smoke detectors-

Smoke detectors are a device that senses smoke,typically as an indicator of fire.Commercialsecurity devices issue a signal to a fire alarm control panel as part of fire alarm system.

7.15 Operation Theatre Protocol by microbiologist before starting the OT

Before performing the surgery in a new Operation Theatre, the following protocol is recommended:

1.AC duct and HEPA filter placed and tested.
2.Air quality testing done
3.All UPS points and OT lights checked.
4.All water points and drains checked.
5.Humidity and temperature check to be done with load (at least equipment)
6.Doors to be checked whether they close completely (no gaps or leakage)
7.OT table alignment and leveling to be done.

Scrapping if any cement deposits or paint anywhere and vacuum cleaning of OTs to remove dust.

- ✓ Theatre walls and floor should be scrubbed thoroughly with soap and water
- ✓ After scrubbing, the same should be cleaned with clean water
- ✓ Clean the walls and floors with chemical disinfectant
- ✓ Dry it and make it completely dust-free
- ✓ Cleaning and disinfection of all equipment
- ✓ Fumigation of room with all equipment placed in the theatre

- ✓ Take swabs for culture from floor, walls, door, door handle, air-condition diffusers, OT table and other major equipments. At least, two swabs should be taken from each item
- ✓ Air sampling for cultures
- ✓ Take swabs for 3 consecutive days while continuing the fumigation every day night
- ✓ If all the samples are negative, the theatre can be put to use
- ✓ If any sample shows positive, the above procedure has to be repeated

Note:

- Sampling is done for Aerobic, Anaerobic and Fungal cultures.
- If any humidity is noted, dehumidifier can be used.
- After fumigating the room, no one is allowed in the theatre except the person who is going to take the swabs for culture.
- After initial wash, the zoning system of theatre should be maintained and if it is required to enter the theatre complex, it should be allowed only after changing into scrub suites with cap and mask.
- Positive pressure should me maintained in the theatre after the first swab.
- Movement of any equipment is not allowed in the theatres during this period.
- If any non-pathogenic organisms are grown in the sample, the same may be ignored.
- Microbiologist will be the final authority to give clearance.

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7.16 Interview and discussions

7.16.1 Anaesthetist discussion

Name-Dr. vivek chaudhary

POST- Chief cardiac anaesthetist (HOD)

1.There should be a Partition between pre and post-operative room post operative room is directly visualise from pre-operative room, it can cause the anxiety to the patient who are going for surgery.

2. There is common corridor for post-operative patients and pre-operative Patients which should be separated. The sterile corridor should only use for Post-operative patients only.

3. All pillars and corners should be rounded in shape for infection control which is not done in some places in OT.

4. Separate HOD/ cardiac anaesthesia room for confidential managementfor Meeting purpose.

5. There is no any minor OT for accident of injury patient for immediate stitching.
These kinds of patients would have direct entry in sterile OTs which makes them unsterile.so there should be a minor OT outside the sterile area.

7.16.2 OT Sister discussion

Name-(Ahilya sister)

POST- CT OT incharge(sr.Nurse)

1.Head end of operation table is not appropriate in operation theatre which Would Create technical problem. (Pt. shifting problem, disturbance to surgeon during surgery)

2.CT OT storage room and washing room should be given separately because instruments are more expensive.

3.Pharmacy room is common for all OTs , it would create trouble need extra man power.

4. Moving instrument traully with electrical connections needed.

5. Cautery machine should place near the patient not on distant pendent.

6. Convert sterile wash room into unsterile room, use it for instrument wash and packing purpose, and give this space for CT department nurses because there is no space for CT OT nurse for taking rest after the case.

7.16.3 Biomedical Engineer conversation

Name-Akshya swain

Post-HOD biomedical department

1.Temperature control system should be from OT complex but in our OT it is regulated from BMS (building management system).not clear yet what to do

2. Overall OT designing is fine OT corridor spacing is much better than other hospitals.There are good space available in OT rooms.

Name-Desh Dipak Das

Post-sr.biomedical engineer

1. Total number of UPS points should not exceed total number of equipment.
2. Most of electrical points should at head end side of OT table but in these OTs most of points are in opposite side.
3. Dirty linen room should not be in between sterile area it should be outside OT area.
4. .Laminar air flow vent window should be at slightly upper height,
   (When air strikes to the floor it goes up) .

5. OT is well equipped with ceiling mounted pendants.

6. OT doors are sliding and sensor based which is good thing.

7. Scrub area is also sensor based which is also a good feature.

7.16.5 Quality manager discussion

Name-Malvika Tripathy

Post- HOD quality

1. OT is not unidirectional.

2. Scrub areas are less two scrub areas for 6 OTs.

3. Scrub areas are overlapping with CSSD.(CSSD on separate floor)

4.No separate way for BMW waste material.(public area opening),which should be think again.

5. Pre op/post op room situated in restricted area which is a good thing.

6.separate Counselling roomwhich is good thing.

7. There is a separate path in changing room for going into OT, good thing.

8 .Modular OT, good technological inputs.

7.16.6 A PART OF DAILY DISCUSSIONS…….AND SUGESSITIONS…….

OT -1 /OT-2	**Requirements-** 1. Moving instrument traully with electrical connections. 2.cautery machine should place near the patient not on Distant pendent. 3. Pillars should be rounded in shape for infection control.
sterile wash room-	1.convert it into unsterile room ,use it for instrument wash and Packing purpose, and give this space for ct department nurses.
storage rooms -	1.CT OT storage room and washing room should be separate because instruments are more expensive.
step down CT ICU-	1. Not accepted because it is dark ,no natural light suggesting to convert it into neuro ICU.
positive air pressure correction-	1. correct all positive pressure isolation rooms into negative pressure isolation for better infection control.
CT Corridor-	1.separate cardio thorasic corridor. 2. separate HOD,cardiac anaesthesia room for confidential management Meeting purposes.

7.17 Conclusion-

The OT complex is overall good and enriched with modern facilities and equipment. Good space and corridors are available, Separate six OTs with modern designing and best methods of infection control, Eco friendly building with energy saving systems.

But the designing of OT complex creating a challenge for planning the flow of pre and post operative patients, flow of sterile and non sterile equipment to CSSD. Commissioning process is not completed yet.

7.18 Recommendations-

Basic things which need to be correct before starting of OT.

1. There should be partition between pre op and post op rooms to prevent the view and anxiety of pre -op patients by seeing the post -op patients.

2. Establish unidirectional flow of OT.

3. Ensure the proper flow of biomedical waste flow which should not cross the public area.

4.one minor procedure room (for road traffic accident patients) outside the sterile zone or in ER. Department to prevent the sterile zone from infection.

5.in some places in OT corners are not rounded which would be the source of infection ,it should be rounded in shape.

7.19 Limitation of study

1. Due to shortage of time many things are remained unexplored .commissioning process is not completed yet,which is going on.

8.Bibliography

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9 ANNAXTURE-

9.1 Snag list of OT complex during commissioning process-

Sl. No	Location	Pending Activity	Status	Remarks
1	Air Lock	False Ceiling painting	Completed	
		Wall painting	Completed	
		Vinyl flooring	Completed	
		Door Frame screw cover		
		Access control system		
2	OT 1	Intake louvers		
		Hepa filters & UV lamp to be fixed at plenum.		
		Plenum face plate		
		Thermostat for AHU control		
		AHU testing & commissioning with report		
		OT validation report (Air velocity & particle count)		
		Magnehelic gauge need to be fixed		
		Smoke detector fixing		
		Power for pendent		
		MGPS supply to pendent through flexible pipe		
		Surgeon control panel testing		
		Earthling strip need to be connected with earth pit		
		Procedure lamp		
		Power supply for auto door		
		Isolation panel testing		
		Cupboard self & door work		
		OT ceiling painting	Completed	
		Wall painting	Completed	some touch up required
		MGPS pipeline colour code		
		Vinyl should be paste properly with wall (at two spot)		
		Auto door release switch board side gap to be filled		
		Hole to be closed at earth busbar area		
		One light fixing		
		SS rak 2 nos		
		Deep cleaning		
3	OT 2	Intake louvers		

		Hepa filters & UV lamp to be fixed at plenum.		
		Plenum face plate	Completed	Finishing not good,all will be replaced
		Thermostat for AHU control		
		AHU testing & commissioning with report		
		OT validation report (Air velocity & particle count)		
		Magnehelic gauge need to be fixed		
		Smoke detector fixing		
		Power for pendent		
		MGPS supply to pendent through flexible pipe		
		Surgeon control panel testing		
		Earthling strip need to be connected with earth pit		
		Procedure lamp		
		Power supply for auto door		
		Isolation panel testing		
		Cupboard self & door work		
		OT ceiling painting	Completed	Some touch up required
		Wall painting	Completed	some touch up required
		MGPS pipeline colour code		
		Hole to be closed at earth busbar area		
		One light fixing		
		SS rak 2 nos		
		Deep cleaning		
4	OT 3	Presently this OT will use as a room, so temporary arrangement will be done.		
		AC ducting & diffuser	Completed	
		AC duct will taping with another AHU		
		Light & power plug work	Completed	
		All AC duct opening to be closed	Completed	
		False Ceiling painting	Completed	touch up required
		Wall painting	Completed	
		Door hardware		
		Data point		
		Film for window glass		
		Trap door		
5	OT 4	Intake louvers		

		Hepa filters & UV lamp to be fixed at plenum.		
		Plenum face plate		2 nos hepa box small size
		Thermostat for AHU control		
		AHU testing & commissioning with report		
		OT validation report (Air velocity & particle count)		
		Magnehelic gauge need to be fixed		
		Smoke detector fixing		
		Power for pendent		
		MGPS supply to pendent through flexible pipe		
		Surgeon control panel testing		
		Earthling strip need to be connected with earth pit		
		Procedure lamp		
		Power supply for auto door		
		Isolation panel testing		
		Cupboard self & door work		
		OT ceiling painting	Completed	
		Wall painting	Completed	some touch up required
		MGPS pipeline colour code		
		One light fixing		
		Blank plate fixing		
		Film for window glass		
		SS rak 2 nos		
		Deep cleaning		
6	OT 5	Intake louvers		
		Hepa filters & UV lamp to be fixed at plenum.		
		Plenum face plate	Completed	Finishing not good,all will be replaced
		Thermostat for AHU control		
		AHU testing & commissioning with report		
		OT validation report (Air velocity & particle count)		
		Magnehelic gauge need to be fixed		
		Smoke detector fixing		
		Power for pendent		
		MGPS supply to pendent through flexible pipe		
		Surgeon control panel testing		

		Earthling strip need to be connected with earth pit		
		Procedure lamp		
		Power supply for auto door		
		Isolation panel testing		
		Cupboard self & door work		
		OT ceiling painting	Completed	some touch up required
		Wall painting	Completed	some touch up required
		MGPS pipeline colour code		
		One light fixing		
		Blank plate fixing		
		Film for window glass		
		SS rak 2 nos		
		Deep cleaning		
		Window glass screw 2 nos		
7	OT 6	Intake louvers		
		Hepa filters & UV lamp to be fixed at plenum.		
		Plenum face plate		
		Thermostat for AHU control		
		AHU testing & commissioning with report		
		OT validation report (Air velocity & particle count)		
		Magnehelic gauge need to be fixed		
		Smoke detector fixing		
		Power for pendent		
		MGPS supply to pendent through flexible pipe		
		Surgeon control panel testing		
		Earthling strip need to be connected with earth pit		
		Procedure lamp		
		Power supply for auto door		
		Isolation panel testing		
		Cupboard self & door work		
		OT ceiling painting	Completed	some touch up required
		Wall painting	Completed	some touch up required
		MGPS pipeline colour code		
		2nos light fixing		
		Blank plate fixing		
		Film for window glass		

		SS rak 2 nos		
		Deep cleaning		
8	Corrid or	AC diffuser	Completed	
		Fixing of geyser with connection pipe & valve	Geyser installed	Connection pending
		Hot water line testing		
		Connection pipe for scrubber & testing		
		Floor drain p trap need to be cleaned properly.		

9.2 <u>Commissioning details-</u>

Sr.no.	Equipment Name	quantity	Delivery date	Present status of delivery & installation site
1.	O.T lights	6	Installed	Installed
2.	OT table	5	To be confirmed	Consignment clear from the customs Transfer to site is delaying for the payment
3.	Anaesthesia m/c	5	Delivered	Clarence not given by corporate office for installation for the saving of warranty
4.	C Arm	1	Delivered	Clarence not given by corporate office for installation for the saving of warranty
5.	Heart lung Machine	1	LC to be opened,2 weeks from	Not delivered, Site IS not ready For installation.
6.	XRay			Final commission pending for permanent electric supply & AC
7.	R.O Plant - Material receiving	1	10-4-16	Are in transit.
8.	R.O Plant - installation		4 days prior to Material receiving	Material not received.
9.	Monitors	117	Delivered	kept in store for installation.
10.	Portable Ultrasound	Not known	25-4-16	Not delivered, PNDT permission required

Sr.no.	service	Hi-side installation	Status
1.	Electrical		
		Earthling completion	All pits are ready but waited for copper and GI Strip to connect with equipment.
2.		Approvalfor HT	It is at final stage
		Ht line external	Work not started
		Sub-station	Transformer,HT panel,Kiosk panel are at Sub-station yard,but Erection work not started
		LT Panels- last lot inspection	Not done
		Delivery of panels	Expected date 18.04.2016
		Terminations	Minimum 10 days from date of delivery
		Energzing the HT	After completion of HT approval,HT external line, substation electrical work.
		Rising mains	all tap up box connection work completed and from tap up box to floor panel cableling and termination work in progress
		Floor panel & DBs	All floor panel at there place and three floor cable termination work completed & rest work going on.Light DBs termination work going on & for other DBs .waited for materials.
3.		Sync pane	Waited for panel
		DG	Testing and commissioning pending, planned for 22 April
	UPS	Installation & connectivity Commissioning	After completion of UPS installation & connectivity.then it will happen
	HVAC	3rd floor	
	commissioning of Chillers		
	Meanwhile AHU ready for commissioning		
	Ventilation & exaust system		
	hot water	-	Delivery of system
		installation& Commissioning	After getting the materials.
	RO plant	Delivery of system	

9.3 <u>Operation Theatre Checklist before commissioning</u>

1.OT suites: Ancillary accommodation	Available	requirement	Timeline	remark
Changing room				
Reception room				
Transfer				
Preoperative intensive care room				
post-operative intensive care room				
sterile store				
equipment stores				
diagnostic facility if any				
2.Operative suites consist of:				
Operation room				
Preparation room				
Anaesthesia room				
Scrub gowning room exit bay				
3. independent of general traffic				
4.Different zones (outer protective zone ,middle zone, inner sterile zone and disposal zone)				
5.Remove dirty materials from the OT without passing through clean area				
6. Air flow check (airflow direction from cleaner to less clean areas)				
7. air movement - 1.3cubic mm/minute with 12-14 Changes /hrand 2-4changes /hr for				

other areas (as per standard)

8. OT temp around 28* C pressure by 5mm Hg
(fresh air at 208tr with 55% humidity)

9. floor (earthling condition)

10. walls washable paint

11. walls joint less and corner rounded

12 fittings steel frames /glass/flush

13.doors (what type)?

14.Furniture/fixtures
