STUDY ON OPERATION THEATRE SCHEDULING BY USING DMAIC APPROACH

Internship Training
at
The Mission Hospital Durgapur, West Bangal

By
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Under the guidance of
Dr. Nutan P. Jain

MBA Hospital & Health Management
2013–15

Institute of Health Management Research
Jaipur
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Internship Training at The Mission Hospital

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(February 2nd 2015-April 30th 2015)

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

IIHMR UNIVERSITY

TO WHOMSOEVER MAY CONCERN

This is to certify that Dr.Swati Anand student of MBA Hospital and Health Management from IIHMR University, Jaipur has undergone internship training at The Mission Hospital Durgapur, West Bengal from February 2nd, 2015 to April 30th 2015.

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 his future endeavors.

Col. (Dr).Ashok Kaushik
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for Prof. Nutan P. Jain
Professor
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May 5, 2015

CERTIFICATE OF DISSERTATION COMPLETION

TO WHOM IT MAY CONCERN

The certificate is awarded to **Dr.Swati Anand** in recognition of having successfully completed her dissertation in Operation Theatre Complex. She has successfully completed her Project on "**A study on Operation Theatre Scheduling using DMAIC approach**" from February 2nd to April 30th, 2015 in **The Mission Hospital, Durgapur (West Bengal).**

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning. We wish her all the best for future endeavors.

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled "**A study on Operation Theatre Scheduling using DMAIC approach**" and submitted by Dr.Swati Anand, Enrollment No.IIHMR/2013-2015/1512 under the supervision of Prof.Nutan. P. Jain for award of MBA Hospital and Health Management of the university carried out during the period from February 2015 to April 2015 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

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List of Abbreviations

ENT-Ear, Nose and Throat

ITU- Intensive Treatment Unit

OT-Operation Theatre

CSSD-Central Sterile Supply Department

HMIS-Hospital Management Information System

GDA-General Duty Assistant

RMO-Registered Medical Officer

TMT-Treadmill Test

ECG-Electrocardiogram

SA-Spinal Anesthesia

GA-General Anesthesia

SE-Sedation

TPA- Third Party Administrator

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1. Introduction

Operation theatre is the most vital and imperative facility of a hospital. It is the heart of any hospital where all the surgical procedures are performed. The concept of "operating theatres" has its origin in its history around 15th century. Earlier there used to be an elevated table and all around raised chairs for students to see the operation. Modern OR is said to have descended from the Roman Military tent and hospital system. Like all other medical facilities, Operation theatres are also the offspring of wars. Subsequently the word 'operation theatre' (OT) has been replaced by 'operation room' (OR) which refers to the room in which surgery takes place. The operating room with ancillaries is called as operation theatre/suite and numbers of operation theatres or suits together form an Operation Unit/ Operation Theatre complex. The concept of these conventional Operation Theatres has seen a drastic drift to the modern Operation rooms with Laminar Airflows and state of art equipments. There has been transformation of operation theatres as the place where surgical procedures are conducted to operation theatre complex where not only surgical procedures are performed but also the patients care and safety are also of essence.

Scheduling of Operation theatre is an important factor contributing to the operation theatre efficiency. It involves determining the average length of common operations and fitting them into the calculated available operating time The scheduling of Operating Theatre plays an important role towards the patients satisfaction by minimizing his/her total waiting time before undergoing major or minor operations. Poor scheduling of Operating Theatre may cause preoperative delays. The operation theatre is a high revenue generating department within hospital .Considerable resource is wasted if operating room is not used effectively.

.

Thus quality of care in surgical unit is a measure of timely, safe and best care to patients. The critical concern for hospitals is improving quality while simultaneously reducing cost. Different organizations use different methodologies and tools for implementing a quality management and programmes for quality improvement such as seven quality tools such as (control charts, pareto analysis, cause effect analysis, Failure mode effect analysis, Poka yoke, Flow chart etc). One of the methodologies used for hospital operations process is Six Sigma which constitutes a number of approaches and techniques for quality improvement. One such approach of Six Sigma is DMAIC (Define, Measure, Analyze, Improve and Control) and this approach can be used to streamline and improve the Operation Theatre Scheduling by using different quality improvement tools. The simplified definitions of each phase of DMAIC are:

- **Define** the system, the voice of the process and their requirements, and the project goals.
- **Measure** key aspects of the current process and collection of relevant data.
- **Analyze** the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.
- **Improve** or optimize the current process based upon data analysis.
- **Control** the future state process to ensure that any deviations from the target are corrected before they result in defects and continuously monitor the process

2. Review of Literature

- Preoperative delays hinder the optimal flow of patients and are a source of patient frustration. Several studies focused on multiple aspects of preoperative and Preoperative delays in performing the surgical procedures and tried to delineate the causes for operating room delays, so that effective interventions can be implemented to reduce these delays. Minimization of these delays with effective intervention and planning can cut down the costs of operating rooms and increase the profit margin to the hospitals[1]
- One of the factors that has a significant impact on Preoperative delays is the delay in starting the first case of the day. Delayed start for the first case of the day will have a ripple effect as the following cases get delayed which result in patient annoyance and disruption of operating room and staff schedules. Avoiding the delay in first case would not only be beneficial from a financial perspective but the quality of patient care, appropriate utilization of staff time and resources available are improved. This study focused exclusively on the delay in starting the first case each day in the operating rooms of Harrisburg hospital and Community general hospital. The advisory committee has set the national bench mark of 59% for the number of first cases being wheeled in on time in each operating room. This cutoff mark is for the hospitals who do not accept the 5 minute grace period policy and for those who have the 5 minute grace period policy the bench mark has been set at 72%. In March 2009 the percentage of first cases being wheeled in on time was 13% in Harrisburg hospital and 6% in Community general. Both the hospitals were significantly below the appropriate marks setup by the advisory committee. The intervention method designed to be used in the study was the lean six sigma approach i.e,DMAIC.[2]
- A study by Janice Ahlstrom, etal (2007) explains the lean methodology implications in health industry & involvement of cost, & certain factor which are critical to quality in hospital scenario. Vinukondaiah.K, Ananthakrishnan.N, Ravishankar.M. explored the time

gap between two casess i.e. end of previous case till the start of next case. This is one of the important phases in OT, where many activities are overlapped viz., information to the next case, coordination with next case surgeons, anesthetists, nurses, technicians. A research study by Dexter F, Macario A, Traub RD.(1999) carried out at a tertiary care hospital with the objective of assessment of utilisation of OTs and identification of bottlenecks[3]

- Belien and Demeulemeester (2007) propose and evaluate models for the construction of the master surgery schedule with levelled resulting bed occupancy. Scheduling and sequencing the patients (stage three) has received much attention in the literature and has been approached in many ways. [4].
- Dexter and Traub (2000) applied decision theory to the process of sequencing patients.[5]
- Robust scheduling includes 'buffers' that absorb variations in treatment times that occur during project execution. Schedule robustness is defined by Daniels and Kouvelis (1995) as the determination of a schedule whose performance is relatively insensitive to the potential realisations of the task parameters. In the online environment, the performance of pre-computed schedules degrades, as continual upgrades are required due to disturbances. Robust schedules are generated such that the schedule performance remains high even in the presence of such disruptions [6].
- Hans et al. (2008) introduce assigning surgeries and planned slack time to the operating room days to prevent overtime. The planned slack time on each operating roomday is based on the expected variance of the surgical durations planned on that day. The problem is formulated to minimise expected overtime and planned slack time, thereby theoretically freeing up operating room capacity. [7].

- Stuart and Kozan (2009) adapted the idea of robust scheduling under the assumption of lognormally distributed surgical durations. The schedules were compared with the normally distributed surgical duration case. [8].

3. Rationale of study

Operation theatre is the most important cost centre of any hospital. Operation theatre not only involves the maximum expenditure but is also the primary source of revenue generation for hospital. Thus it is a vital expenditure and revenue centre at the same time. For maximizing the cost benefit ratio of operation theatre complex, hospitals needs to utilize operation rooms in most efficient manner possible.

The operation theatres are fundamental centers both for hospital as well as patients. Surgical operations are an important part of hospital acute activity. For many patients they are the sole reasons for hospital admissions. Thus it necessitates the hospital to ensure the '**Right case at right place to right person in right time'**. Thus purpose of this study is to gain insight into the theatre efficiency and by the measure of incidence and reason for delays to operating theatre list.

4. Research Questions

- Are there any first case delays or in between case delays of Operation list schedule.
- What are the facilitating or hindering factors affecting Operation theatre time scheduling.

5. Aim

The study aims at enhancing the operation theatre efficiency as well as patient satisfaction by OT scheduling

6. Objectives

- To observe the operation theatre time schedule and to find out whether surgery is performed on schedule time or not.
- To identify the gap between scheduled time and actual time of surgeries, if any.
- To identify the reasons for first case delays and all case delays.
- To provide recommendations to improve the operation theatre scheduling by reducing the first case delays and all case delays.

7. Methodology

- **Study design and approach:** The study is descriptive-cross sectional study as the sample population taken from all the cases or surgeries and should be representative of total cases/surgeries.
- **Location of study:** The study is conducted in OT complex, located on 3rd floor, of The Mission Hospital, Durgapur.
- **Time frame:** The study would be conducted for period of two months (March 2015-April 2015) including all the working days except Sundays and gazetted holidays.
- **Study Timings: 9:00 am-5:00pm**
- **Study Approach:** Six sigma methodology-DMAIC approach
- **Study tool:** Minitab Software
- **Sampling technique:** The sampling technique is purposive sampling
- **Sample size: Total Sample Size:404**
  - Cardiac cases(CABG,MVR,ASD,VSD,TVR,ICR for TOF)=165
  - Ortho cases=97
  - General Cases (Urology, Gynaecology, Plastic, General and Other surgeries) =142
- **Sample Population: Inclusion criteria and exclusion criteria**
- Surgical procedures performed in 3rd Floor OTs for a period of two months i.e. March and April was included in the study.
- Cases performed between 9:00 am to 5:00 pm were included in the study except neuro cases as they were very small in number.
- Cases performed in the 5th floor OT were excluded from the study.

8. Study procedure

To accomplish the objectives of this study ,the approach used in this study is DMAIC approach which is divided into five phases DMAIC (Define,Measure,Analyze,Improve and Control)refers to the data driven life cycle approach to six sigma projects for improving the process,it is an essential part of six sigma.

DMAIC is an acronym for the five interconnected phases: define,measure,analyse,improve and control. The simplified definitions of each phase are as follows:

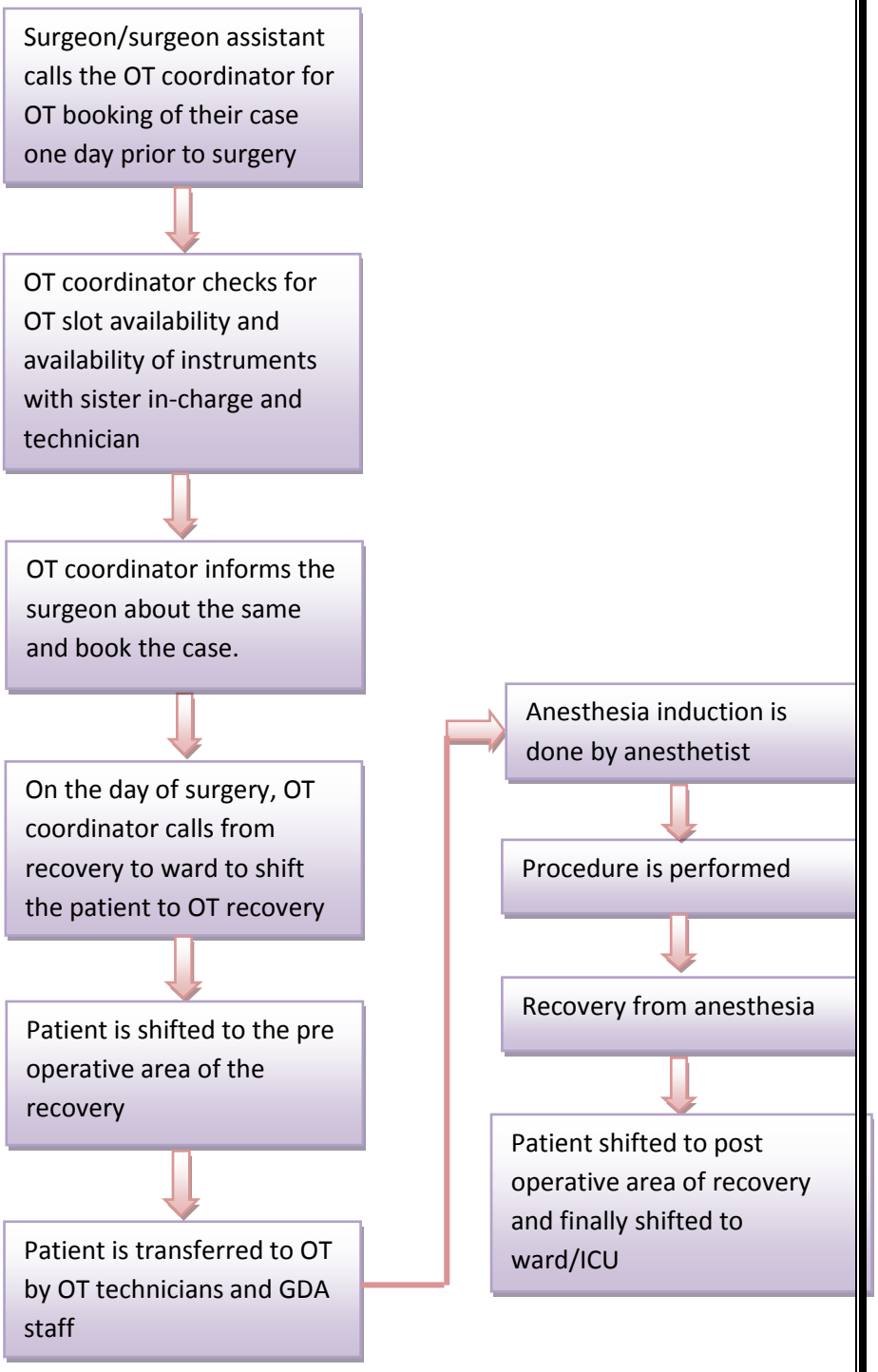
- **Define** the system through current process map, the voice of the process and their requirements.
- **Measure** key aspects of the current process and collection of relevant data.
- **Analyze** the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.
- **Improve** or optimize the current process based upon data analysis.
- **Control** the future state process to ensure that any deviations from the target are corrected before they result in defects and continuously monitor the process

DMAIC is an integral part of Six sigma.It is a systematic and the fact based and provides a rigorous framework of result oriented project management.

8.1PHASE I-Define

The tool used to study the OT scheduling was **process mapping**. It is the technique used to follow the detailed flow of product through manufacturing cycle. A process map is a pictorial representation of the sequence of actions that comprise a process. The resulting process map depicts the inputs , the performers, the sequence of actions the performers take, the outputs of a work process in a matrix or flowchart format, usually combining both words and simple graphics. The process was documented to understand the current sub processes involved in the OT scheduling from the consultant books the surgery to be done till the completion of procedure and patient is wheeled out of Operation theatre.

Figure 8.1: Process map



Explanation: The surgeon or surgeon assistant called the OT coordinator for Operation theatre booking of the case one day prior to the surgery. Then the OT coordinator checks for the OT slot availability depending upon the other cases which are posted on the next day. She also checks for the availability of instruments and medicines required with sister in charge and technician. She also asks the sister in charge that how much time a particular case for which the OT booking has come will require. After checking all this availability the OT coordinator informs the surgeon about the same and book the case. On the day of surgery,OT coordinator calls from the OT recovery area to ward regarding shifting of the patient to the recovery. Patient is shifted to the pre-operative area of the recovery and then when the handover of the patient gets completed and previous surgery is also completed the patient is transferred to operation theatre by the OT technicians and GDA staff. Inside the Operation theatre bed making is done and the patient is transferred to the OT table .After transferring the patient to the OT table, anesthesia is induced to the patient (depending upon the technique of anaesthesia required).After this according to the type of the surgery the patient positioning is done. Then painting with the betadiene solution and draping is done. After this incision is being done then the procedure is started. When the procedure gets completed then the patient is extubated (depending upon the condition of the patient) and finally the patient is shifted to post operative area of recovery. Patient is under closed monitoring in the recovery area and then after his or her condition gets stable and on the advice of the anaesthesist patient is shifted to ward or ICU.

8.2 PHASE II-Measure

This phase is the data collection phase of the study. It aimed at measuring the problem, describe it with process and performance facts, data and metrics The purpose of this step is to objectively establish current baselines as the basis for improvement. This is a data collection step, the purpose of which is to establish process performance baselines. The performance metric baseline(s) from the Measure phase will be compared to the performance metric at the conclusion of the project to determine objectively whether significant improvement has been made.

- **Data collection:** The study would include both primary and secondary method of data collection.
- **Primary data source:** The primary data would be collected through OT case tracking list which includes:
  - Patient's name
  - Age and Sex
  - MR/IP No
  - Ward allocated to him
  - Surgeon's name
  - Surgery or procedure to be performed
  - Anesthetist name
  - Scheduled time for surgery
  - OT allocated for particular case
  - Wheel in time for recovery
  - Wheel in time for OT
  - Anaesthesia Induction time

- Incision time
- Closing time
- Wheel Out time for OT
- Reasons for delay, if any

It also includes informal interview with OT coordinator, OT nursing staff ,OT Technicians, Surgeons and Anesthetists.

- **Secondary data:** The secondary data would be collected through OT case list which includes Patient's Name, Age, Sex, Wards allocated to him or her, Surgeon Name, Anesthetist name, Surgery to be performed, scheduled time for surgery and HMIS.

8.2.1 Speciality wise Data:

Table 8.1: Cardiac Cases

Measurement Parameters	Average Time (in mins)
Case delay	52 mins
Time between patient wheel in OT to induction	23 mins
Time between completion of induction to incision done	26 mins
Time between incision done till the completion of surgery	4 hours 22 mins
Time between completion of surgery to patient is wheeled out of OT	33 mins

- **Time between Patient wheel in OT to Induction**: Time taken when patient is wheel in OT till the completion of induction. This time varies in case of cardiac cases because:
  - If the patient is below 18 years then first anesthesia is being given and then central, arterial or venous line is being done
  - If the patient is above 18 years then first central, arterial or venous line is being done and then anesthesia induction is done.
- **Time between completion of induction to incision done:** Time taken when anaesthesia induction is completed to incision done. This time includes various activites:
  - Positioning of patient according to the procedure

- Painting with betadiene
- Draping of patient

❖ **Time between incision to completion of procedure:** Time taken when incision is completed till the completion of procedure.This time includes various sub procedures of that particular surgery.For example cannulation time and cross clamp time in cases of cardiac surgeries

❖ **Time between completion of surgery to patient is wheeled out of OT:** Time taken from closing of surgical site is done till the patient is wheeled out of OT.

Table 8.2: Ortho Cases

Measurement Parameters	Average Time (in mins)
Case delay	48 mins
Time between patient wheel in OT to induction	10 mins
Time between completion of induction to incision done.	20 mins
Time between incision done till the completion of surgery	1 hr 15 mins
Time between completion of surgery to patient is wheeled out of OT	13mins

- **Time between Patient wheel in OT to Induction**: Time taken when patient is wheel in OT till the completion of induction. This time varies depending upon the type of anaesthesia technique used.
  - Anaesthesia induction (SA): 10 minutes.
  - Anaesthesia induction (GA): 7 minutes.
  - Anaesthesia induction (CSE): 13 minutes.
- **Time between completion of induction to incision done:** Time taken when anaesthesia induction is completed to incision done. This time includes various activites:
  - Positioning of patient according to the procedure
  - Painting with betadiene
  - Draping of patient
- **Time between incision to completion of procedure:** Time taken when incision is completed till the completion of procedure. This time includes various sub procedures of that particular surgery. This time varies depending upon the type of procedure or surgery.
- **Time between completion of surgery to patient is wheeled out of OT:** Time taken from closing of surgical site is done till the patient is wheeled out of OT.

Table 8.3: General Cases

Measurement Parameters	Average Time (in mins)
Case delay	40 mins
Time between patient wheel in OT to induction	10 mins
Time between completion of induction to incision done.	14 mins
Time between incision done till the completion of surgery	1 hr 02 mins
Time between completion of surgery to patient is wheeled out of OT	10mins

- **Time between Patient wheel in OT to Induction**: Time taken when patient is wheel in OT till the completion of induction. This time varies depending upon the type of anaesthesia technique used.
  - Anaesthesia induction (SA): 10 minutes.
  - Anaesthesia induction (GA): 7 minutes.
  - Anaesthesia induction (CSE): 13 minutes.
- **Time between completion of induction to incision done:** Time taken when anaesthesia induction is completed to incision done. This time includes various activites:
  - Positioning of patient according to the procedure

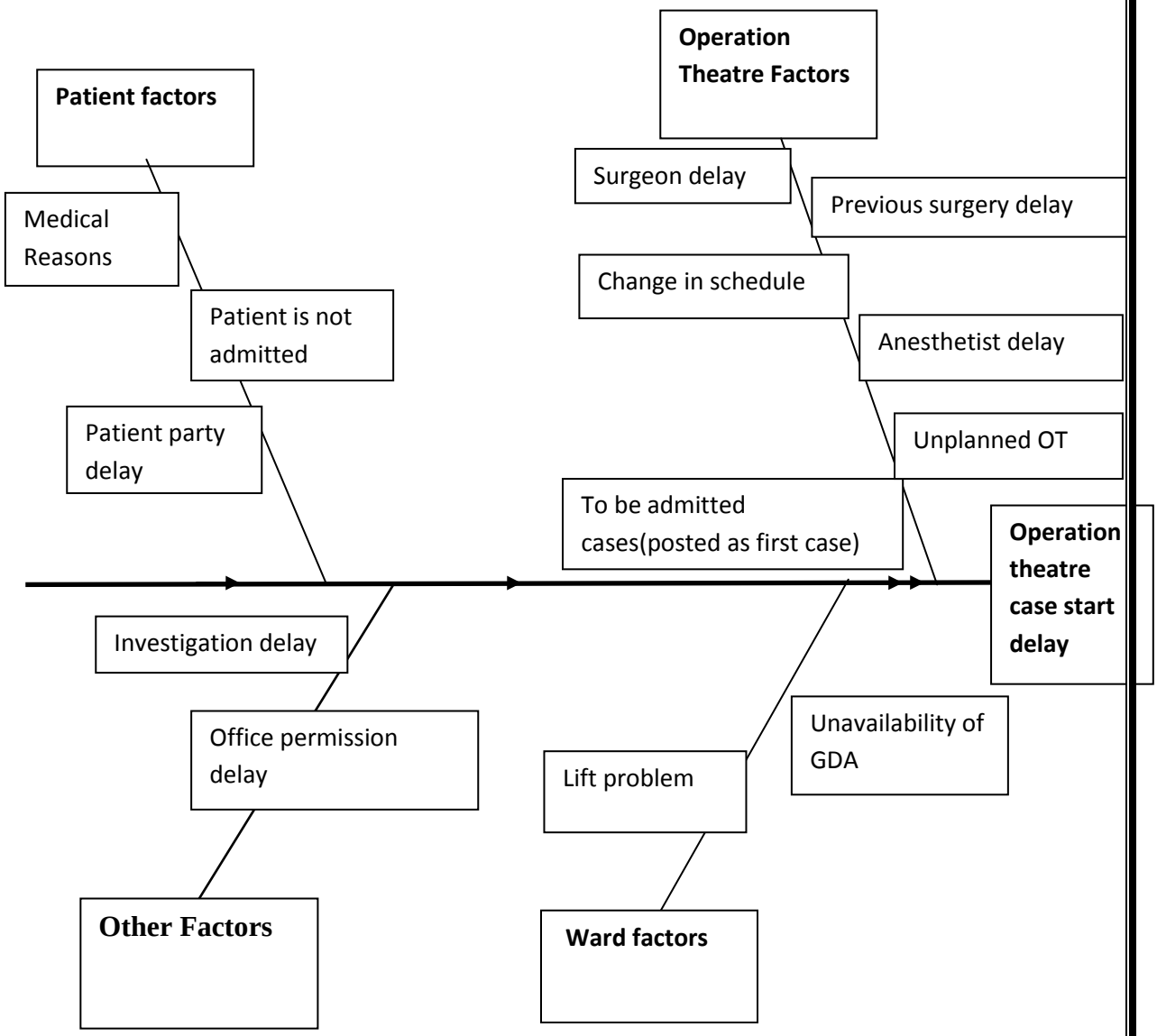
- Painting with betadiene
- Draping of patient

❖ **Time between incision to completion of procedure:** Time taken when incision is completed till the completion of procedure. This time includes various sub procedures of that particular surgery This time varies depending upon the type of procedure or surgery.

❖ **Time between completion of surgery to patient is wheeled out of OT:** Time taken from closing of surgical site is done till the patient is wheeled out of OT.

8.3 PHASE III-Analysis (Specialty wise)

Figure8.2: Cause and Effect Diagram (Fish Bone Diagram)



Interpretation: During the study various factors were identified which were responsible for OT case delay. They are as follows:

❖ **Operation Theatre factors**

There are various factors in the operation theatre which are responsible for OT case delay and they are as follows:

- Surgeon Delay
- Anaesthesist Delay
- Previous surgery delay which occurs due to following reasons:
  - Type of surgery
  - Patient complications
  - Ripple effect of first cases delay.
- Change in schedule of the surgery on the day of surgery which occurs due to :
  - Availability of other free Operation theatre room
  - Surgeon decision
  - Or instrument unavailability for same type of surgery if scheduled one after another
- Unplanned OT which most commonly occurs in emergency cases
- To be admitted cases which were most commonly the day care surgeries were posted as the first case.

❖ **Ward factors**:

There were some ward factors which are responsible for OT case delay and they are as follows:

- Unavailability of GDA
- Infrastructural problems most commonly the lift problem

❖ **Other Factors**

- Office permission delay: Office permission delay means clearance from billing department which occurs in cash, corporate and insurance patients
- Investigations Delay: Investigation delays this occurred due to delay in services of Laboratory and Radiological Department or same day investigations of day-care surgeries.

❖ **Patient factors:**

Patient factors include delay in coming of the patient party. Sometimes patient was not admiited to the hospital even if the bed is booked on his or her name.

8.3.1 Cardiac Cases

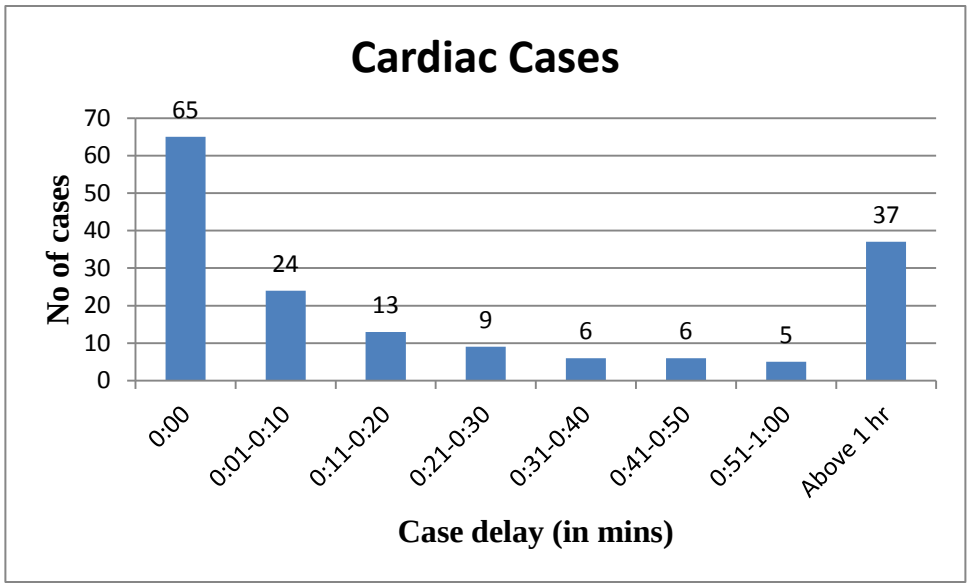
- Total No of Cases:165
- No of cases started on scheduled time: 65 (39%)
- No of cases delayed: 100(61%)
- Average case delay:52 minutes

TABLE 8.4: Cardiac case delay

Time in mins	No of cases
0:00	65
0:01-0:10	24
0:11-0:20	13
0:21-0:30	9
0:31-0:40	6
0:41-0:50	6
0:51-1:00	5
Above 1 hr	37

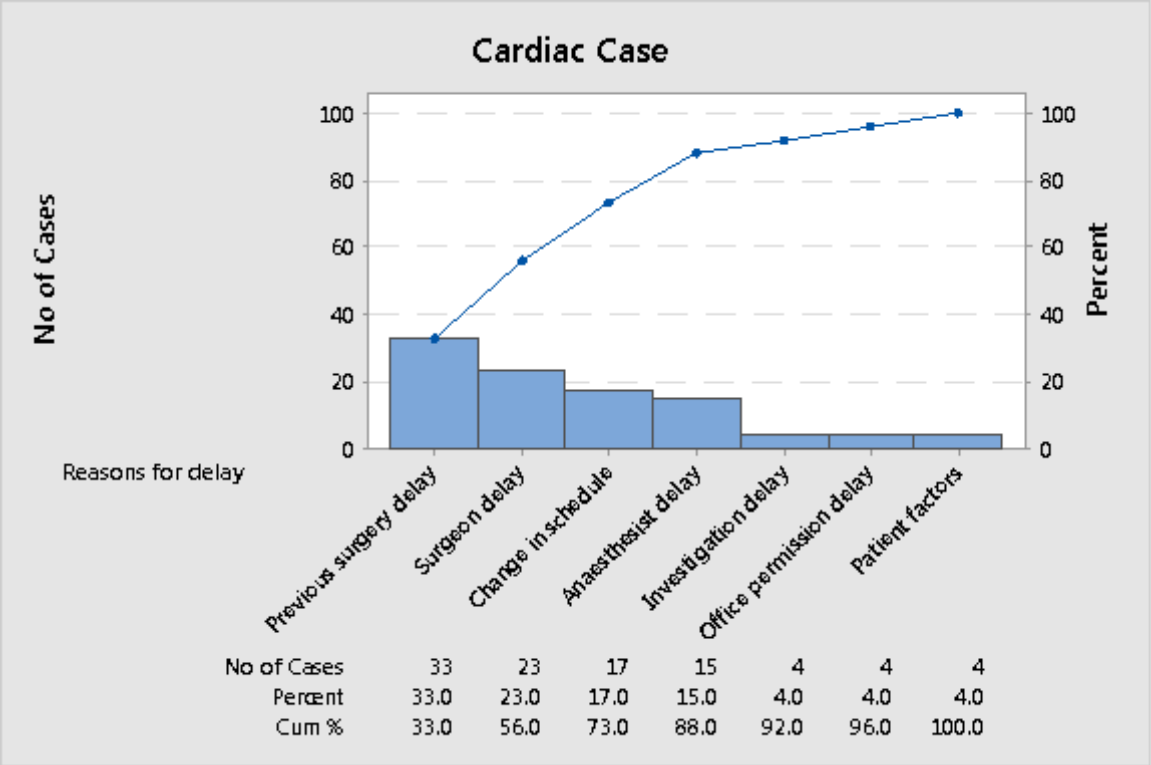
Interpretation: The total no cases which started at scheduled time were 65 and rest of 100 cases are delayed. Within 10 minutes of the scheduled time 24 cases were delayed while 37 cases were delayed for more than 1 hour of their scheduled time..Only 39% of cases started on scheduled time and 61% of the cases were delayed.

Graph 8.1: Cardiac case delay



Interpretation: The total no cases which started at scheduled time were 65 and rest of 100 cases are delayed. Within 10 minutes of the scheduled time 24 cases were delayed while 37 cases were delayed for more than 1 hour of their scheduled time. There was a great variation in the starting of the case at scheduled time. Thus resulting into the case delay.

Graph 8.2: Cardiac Cases Delay (Pareto Analysis)



Reasons for delay of Cardiac Cases based on Pareto Analysis:

Interpretation: The **Pareto principle** (also known as the **80–20 rule**, the **law of the vital few,** and the **principle of factor sparsity**) states that, for many events, roughly 80% of the effects come from 20% of the causes. In case of Cardiac cases 80% of OT case delay occurs from 20% of the causes. Most common reasons which are contributing to Cardiac case delay were:

- Previous surgery delay which accounts for 33% of cases (i.e.33 cases)The following reasons were responsible for previous surgery delay:
  - Type of surgery

- Patient complications
- Ripple effect of first cases delay

- Surgeon delay which accounts for 23% of cases (i.e. 23 cases)
- Change in Schedule of the surgery which accounts for of 17% of cases (i.e.17 cases).The following reasons are responsible:
  - Availability of other free Operation theatre room
  - Surgeon decision.
  - Or instrument unavailability for same type of surgery if scheduled one after another

- Anaesthesist Delay which accounts for 15% of cases (i.e.15 cases).
- Whereas rest of the causes have lesser effect on Cardiac OT case delay.

8.3.2 Cardiac First Cases

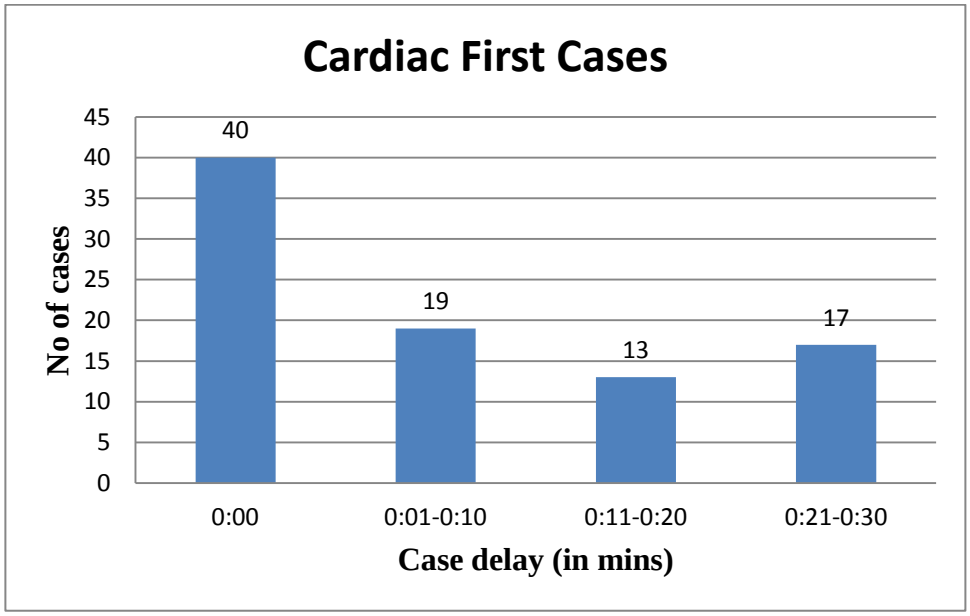
- Total No of Cases:89
- No of cases started on scheduled time: 40(45%)
- No of cases delayed: 49(55%)
- Average first case delay:19 mins

Table8.5: Cardiac First Case Delay

Time(in mins)	No of cases
0:00	40
0:01-0:10	19
0:11-0:20	13
0:21-0:30	17

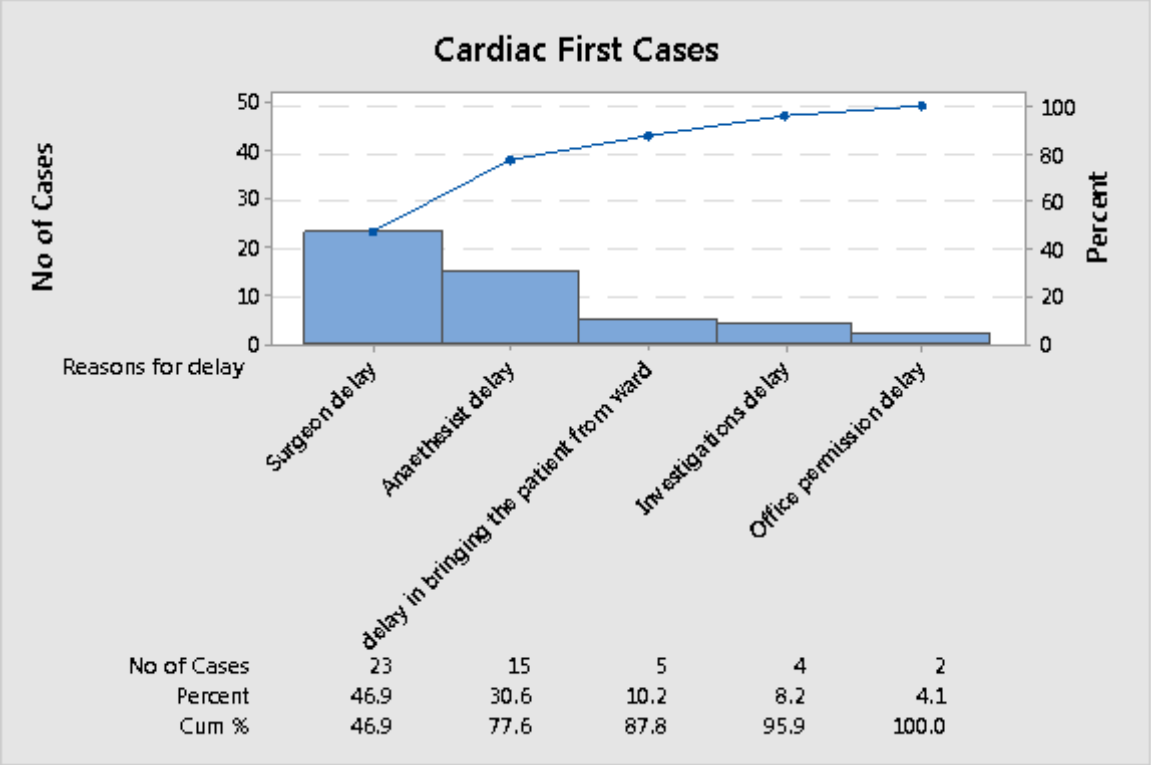
Interpretation: The total no cases which started at scheduled time were 40 and rest of 49 cases are delayed. Within 10 minutes of the scheduled time 19 cases were delayed while 17 cases were delayed for 30 minutes of their scheduled time. Only 45% of cases were started on scheduled time whereas 55% of cases were delayed.

Graph 8.3: Cardiac First Case delay



Interpretation: The total no cases which started at scheduled time were 40 and rest of 49 cases are delayed. Within 10 minutes of the scheduled time 19 cases were delayed while 17 cases were delayed for 30 minutes of their scheduled time. There was a great variation in the starting of the case at scheduled time. Thus resulting into the first case delay

Graph 8.4: Cardiac First Case Delay (Pareto Analysis)



Reasons for delay of Cardiac Cases based on Pareto Analysis:

Interpretation: The **Pareto principle** (also known as the **80–20 rule**, the **law of the vital few,** and the **principle of factor sparsity**) states that, for many events, roughly 80% of the effects come from 20% of the causes. In case of Cardiac cases 80% of OT case delay occurs from 20% of the causes. Most common reasons which are contributing to Cardiac First case delay are:

- Surgeon delay which accounts for 47% of cases (i.e. 23 cases)
- Anesthetist Delay which accounts for 31% of cases (i.e.15 cases).
- Delay in bringing the patient from ward occurs due to :

- Lift problem
- Unavailability of GDA

  This reason accounts for 10% of cases (i.e.5 cases)

- Whereas rest of the causes has lesser effect on Cardiac first cases delay.

8.3.3 Ortho Cases

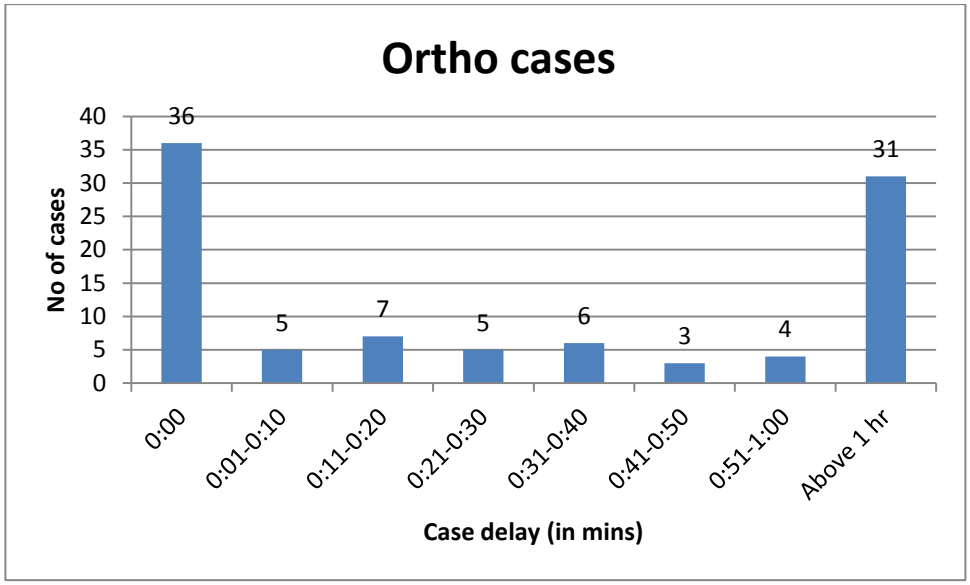
- Total No of Cases:97
- No of cases started on scheduled time: 36 (37%)
- No of cases delayed: 61(63%)
- Average case delay :48 minutes

Table 8.6: Ortho Cases Delay

Time (in mins)	No of cases
0:00	36
0:01-0:10	5
0:11-0:20	7
0:21-0:30	5
0:31-0:40	6
0:41-0:50	3
0:51-1:00	4
Above 1 hr	31

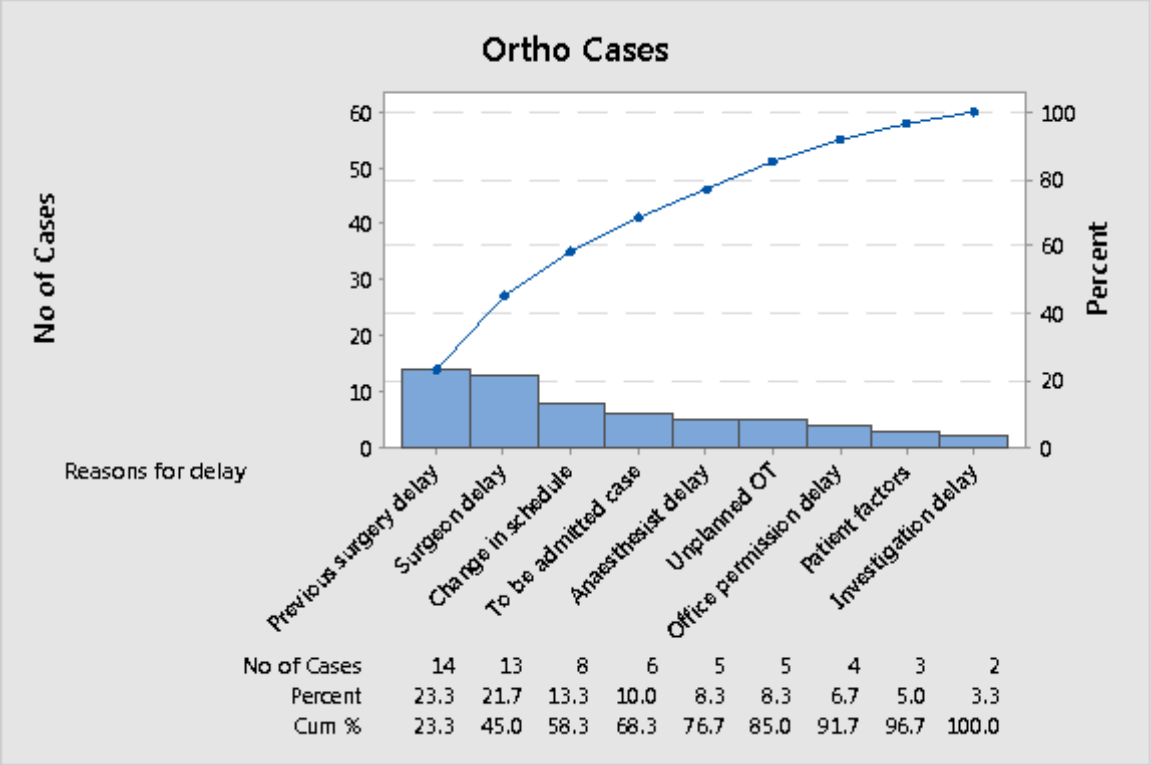
Interpretation: The total no cases which started at scheduled time were 36 and rest of 60 cases are delayed. Within 10 minutes of the scheduled time 5 cases were delayed while 30 cases were delayed for more than 1 hour of their scheduled time. Only 37% of cases were started at the scheduled time whereas 63% of the cases were delayed.

Graph 8.5: Ortho Case Delay



Interpretation: The total no cases which started at scheduled time were 36 and rest of 60 cases are delayed. Within 10 minutes of the scheduled time 5 cases were delayed while 31 cases were delayed for more than 1 hour of their scheduled time. There was a great variation in the starting of the case at scheduled time. Thus resulting into the case delay

Graph 8.6: Ortho Case Delay (Pareto Analysis)



Reasons for delay of Ortho Cases based on Pareto Analysis:

Interpretation: The **Pareto principle** (also known as the **80–20 rule**, the **law of the vital few,** and the **principle of factor sparsity**) states that, for many events, roughly 80% of the effects come from 20% of the causes. In case of Ortho cases 80% of OT case delay occurs from 20% of the causes. Most common reasons which are contributing to ortho case delay are:

- Previous surgery delay which accounts for 23% of cases (i.e. 14 cases) which occurs due to:
  - Type of surgery
  - Patient complications
  - Ripple effect of first cases delay.

- Surgeon delay which accounts for 22% of cases (i.e.13 cases) which occurs mostly commonly in first cases and sometimes they go for in patient rounds in between two cases.
- Change in schedule accounts for 13% of cases(i.e.8 cases) which occurs due to
- Surgeon decision
- Availability of implants and instruments as two cases of the same type of surgery were scheduled together and there were no adequate sets of instruments or implants are not received on time
- To be admitted cases(posted as first case) which accounts for 10% cases (i.e. 6 cases)
- Unplanned OT which accounts for 8% cases (i.e. 5 cases).This occurs most commonly due to emergency cases.
- Anaesthesist delay which accounts for 8% of cases (i.e. 5 cases)
- Rest of the causes have lesser effect on ortho case delay

8.3.4 Ortho first Cases

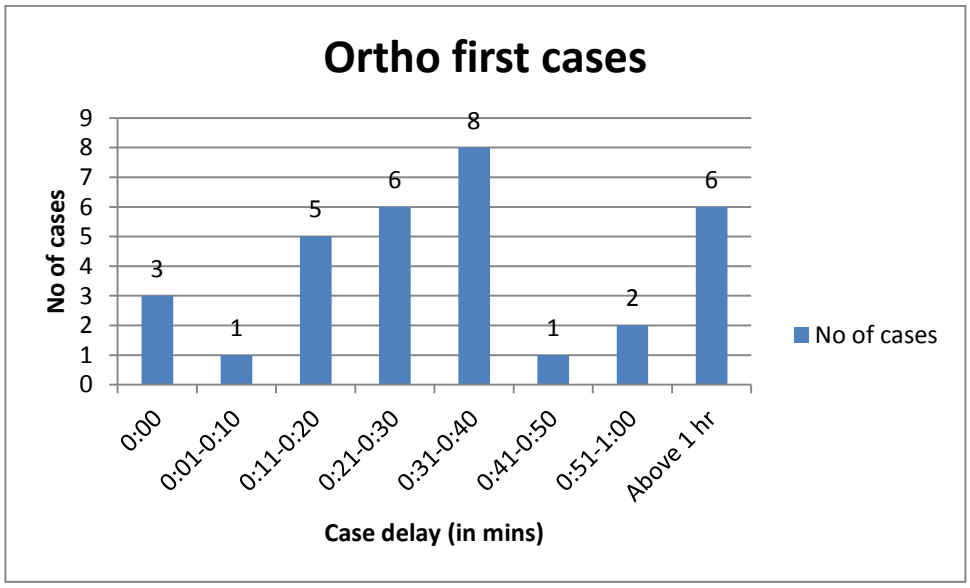
- Total No of Cases:35
- No of cases started on scheduled time:3 (9%)
- No of cases delayed: 32(91%)
- Average first case delay:39 minutes

Table 8.7: Ortho First Case Delay

Time (in mins)	No of cases
0:00	3
0:01-0:10	1
0:11-0:20	5
0:21-0:30	6
0:31-0:40	8
0:41-0:50	1
0:51-1:00	2
Above 1 hr	6

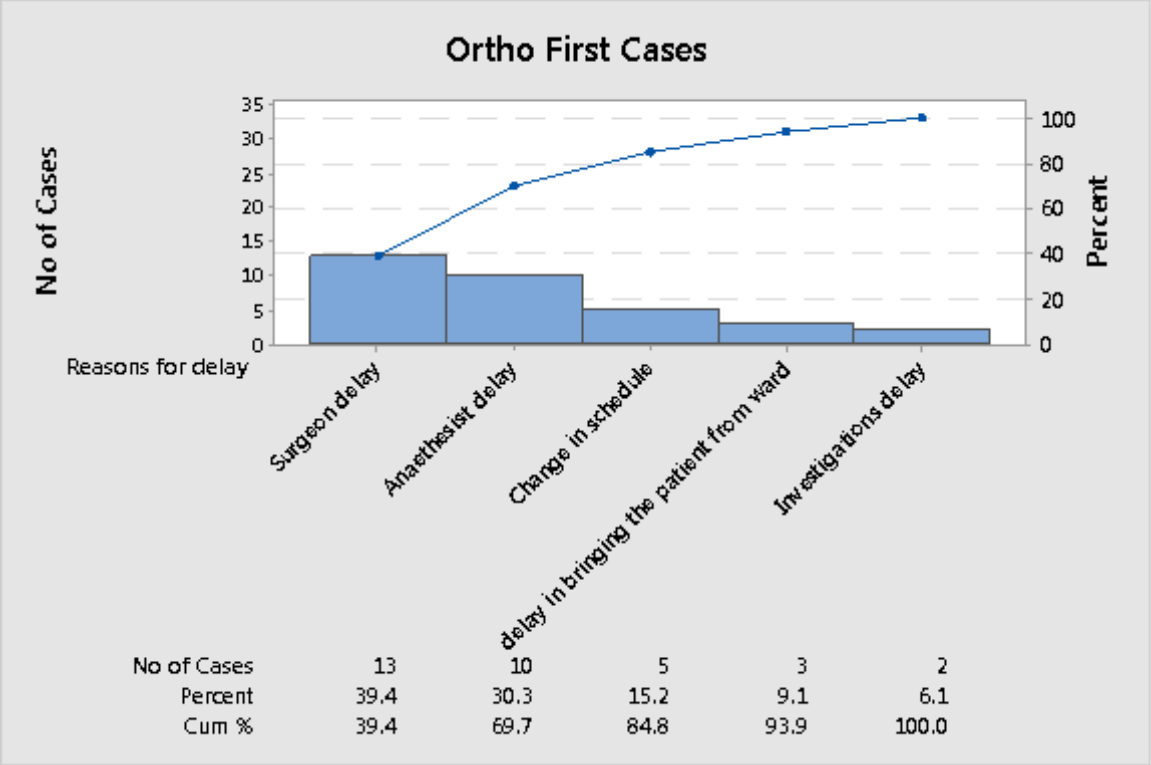
Interpretation: The total no cases which started at scheduled time were only 3 and rest of 32 cases were delayed. Within 20 minutes of the scheduled time 6cases were delayed while 6 cases were delayed for more than 1 hour of their scheduled time. Only 9% of cases were started at the scheduled time whereas 91% of cases were delayed.

Graph 8. 7: 0rtho First Case Delay



Interpretation: The total no cases which started at scheduled time were only 3 and rest of 32 cases were delayed. Within 20 minutes of the scheduled time 6cases were delayed while 6 cases were delayed for more than 1 hour of their scheduled time. There was a great variation in the starting of the case at scheduled time. Thus resulting into the case delay

Graph 8.8: Ortho First Case Delay (Pareto Analysis)



Reasons for delay of Ortho First Cases based on Pareto Analysis:

Interpretation: The **Pareto principle** (also known as the **80–20 rule**, the **law of the vital few,** and the **principle of factor sparsity**) states that, for many events, roughly 80% of the effects come from 20% of the causes. In case of Cardiac cases 80% of OT case delay occurs from 20% of the causes. Most common reasons which are contributing to ortho First case delay are:

- Surgeon delay which account for 39% of cases (i.e.13cases)
- Anaesthesist delay which accounts for 30% of cases (i.e.10 cases)

- Change in schedule of surgery or case which accounts for 15% of cases (i.e.5cases)The reasons which are responsible for change in schedule are:

  - Surgeon's decision
  - Availability of implants and instruments as two cases of the same type of surgery are scheduled together and there are no adequate sets of instruments or implants are not received on time

- Delay in bringing the patient from ward which accounts for 9% of cases (i.e.3 cases) This most commonly occurs due to following reasons:

  - Infrastructure problems- lift problem
  - Unavailability of GDA

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8.3.5 General cases

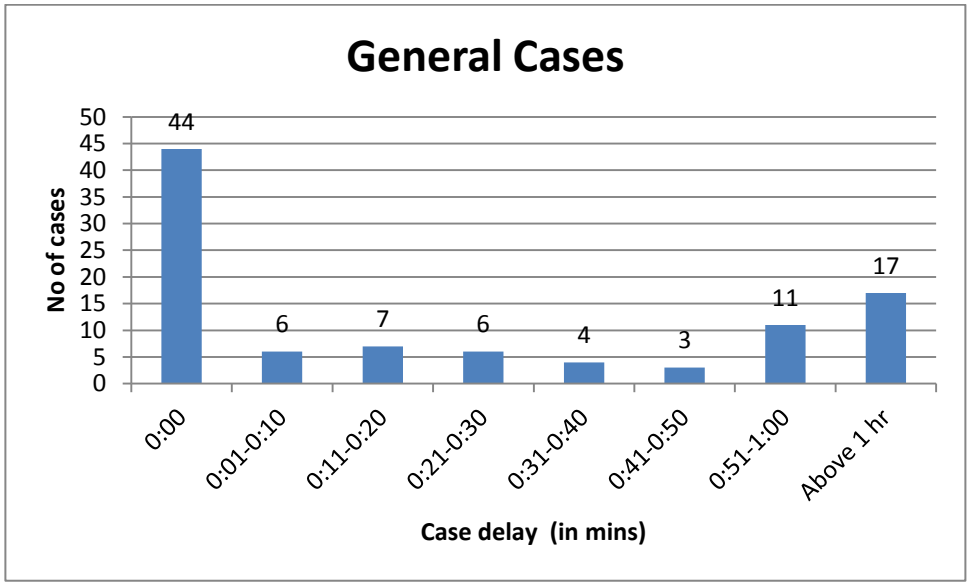
- Total No of Cases:142
- No of cases started on scheduled time:44(31%)
- No of cases delayed:98(69%)
- Average General Case delay:40 minutes

Table 8.8: General Case delay

Time(in mins)	No of Cases
0:00	44
0:01-0:10	6
0:11-0:20	7
0:21-0:30	6
0:31-0:40	4
0:41-0:50	3
0:51-1:00	11
Above 1 hr	17

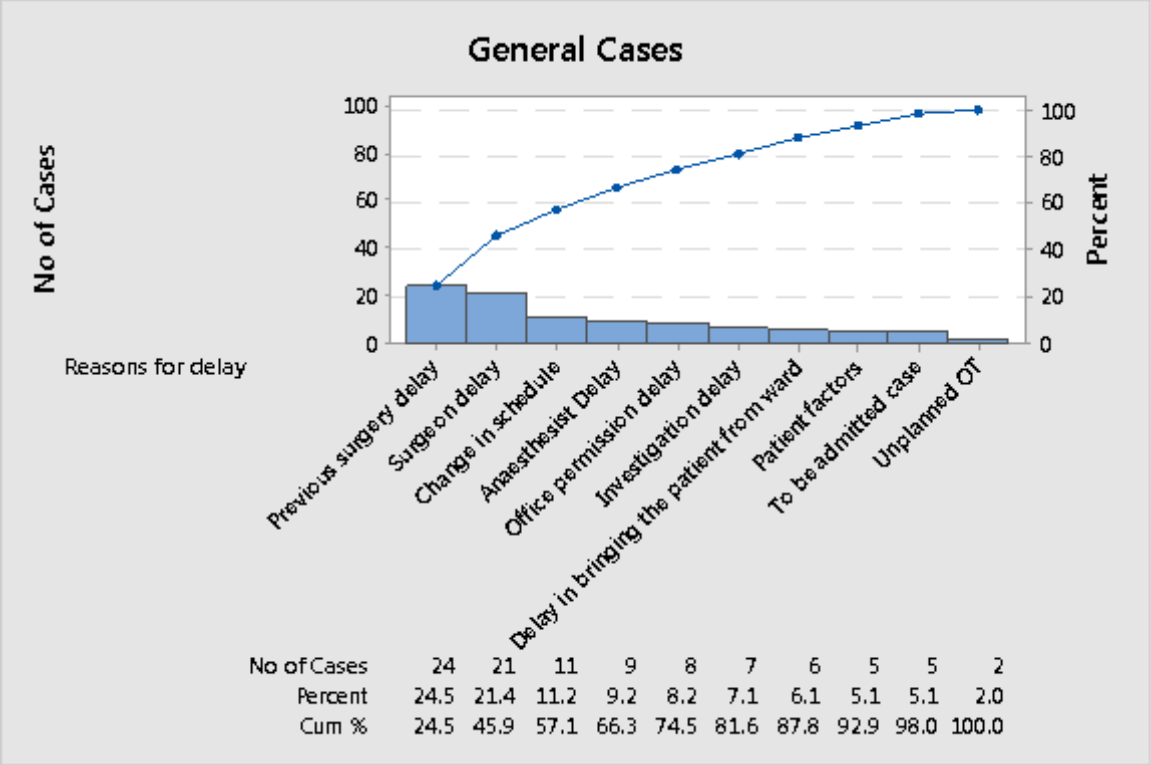
Interpretation: The total no cases which started at scheduled time were 44and rest of 98 cases were delayed. Within 10 minutes of the scheduled time 6 cases were delayed while 17 cases were delayed for more than 1 hour of their scheduled time .Only 31% of cases were started at the scheduled time whereas 69% of the cases were delayed.

Graph8. 9: General Case delay



Interpretation: The total no cases which started at scheduled time were 44and rest of 98 cases were delayed. Within 10 minutes of the scheduled time 6 cases were delayed while 17 cases were delayed for more than 1 hour of their scheduled time. There was a great variation in the starting of the case at scheduled time. Thus resulting into the general case delay

Graph 8.10: General Case Delay (Pareto Analysis)



Reasons for delay of Ortho Cases based on Pareto Analysis:

Interpretation: The **Pareto principle** (also known as the **80–20 rule**, the **law of the vital few,** and the **principle of factor sparsity**) states that, for many events, roughly 80% of the effects come from 20% of the causes. In case of General cases 80% of OT case delay occurs from 20% of the causes. Most common reasons which are contributing to General case delay are:

- Previous surgery delay which accounts for 25% of cases (i.e. 24 cases) which occurs due to:
  - Type of surgery

- Patient complications
- Ripple effect of first cases delay.

- Surgeon delay which accounts for 21%of cases (i.e.21 cases).
- Change in schedule accounts for 11% of cases (i.e.11 cases) which occurs due to patient condition or extended OPD timings of surgeons.
- Anesthetist delay which accounts for 9% of cases (i.e. 9 cases)
- Investigations delay which accounts for 7% of cases (i.e.7 cases)
- Delay in bringing the patient from ward which accounts for 6% of cases (i.e. 6 cases)

This most commonly occurs due to following reasons:

- Infrastructure problems- lift problem
- Unavailability of GDA

- Office permission delay which accounts for 6% of cases (i.e.6 cases) which occurs due delay in getting permission for insurance and corporate patients
- To be admitted cases which accounts for 5% cases (i.e. 5cases)
- Whereas rest of the causes have lesser effect on General case delay

8.3.6 General First Case*:*

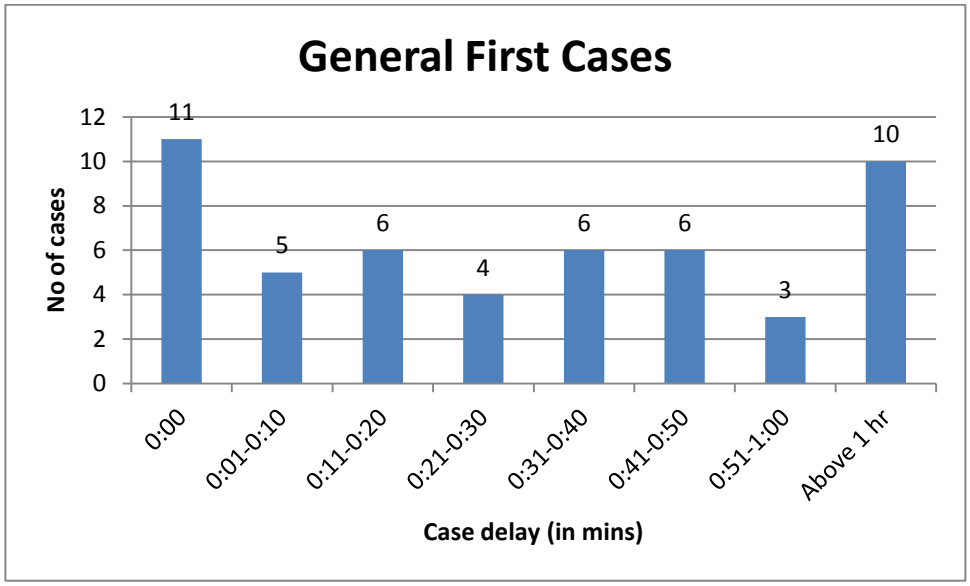
- Total No of Cases:51
- No of cases started on scheduled time: 11(22%)
- No of cases delayed: 40(78%)
- Average General First Case Delay:36 minutes

Table8. 9: General First Case Delay

Time (in mins)	No of Cases
0:00	11
0:01-0:10	5
0:11-0:20	6
0:21-0:30	4
0:31-0:40	6
0:41-0:50	6
0:51-1:00	3
Above 1 hr	10

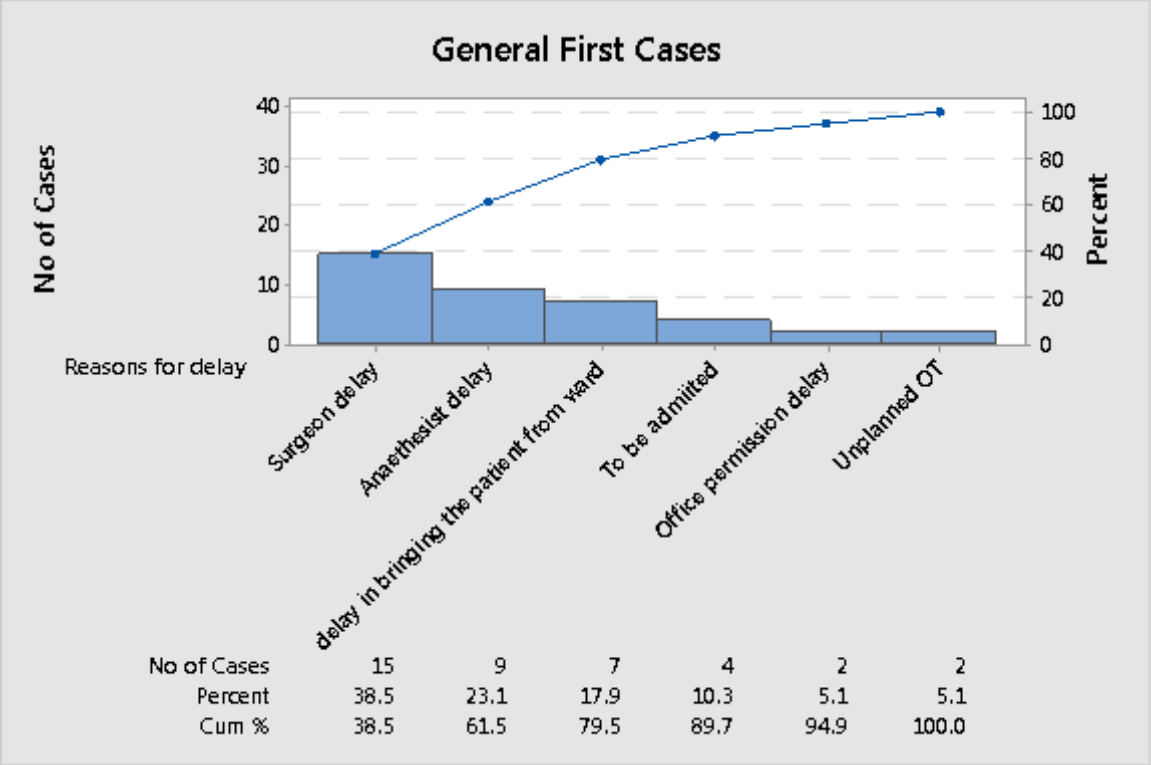
Interpretation: The total no cases which started at scheduled time were 11and rest of 40 cases were delayed. Within 10 minutes of the scheduled time 5cases were delayed while 10 cases were delayed for more than 1 hour of their scheduled time. Only 22% of cases were started at the scheduled time whereas 78% of cases were delayed.

Graph 8.11: General First Case Delay



Interpretation: The total no cases which started at scheduled time were 11and rest of 40 cases were delayed. Within 10 minutes of the scheduled time 5cases were delayed while 10 cases were delayed for more than 1 hour of their scheduled time. There was a great variation in the starting of the case at scheduled time. Thus resulting into the general first case delay

Graph 8.12: General First Case Delay (Pareto Analysis)



Reasons for delay of Ortho Cases based on Pareto Analysis:

Interpretation: The **Pareto principle** (also known as the **80–20 rule**, the **law of the vital few,** and the **principle of factor sparsity**) states that, for many events, roughly 80% of the effects come from 20% of the causes. In case of General cases 80% of OT case delay occurs from 20% of the causes. Most common reasons which are contributing to General case delay are:

- Surgeon delay which accounts for 39% of cases (i.e 15 cases).
- Anaesthesist delay which accounts for 23% of cases (i.e. 9 cases)
- Delay in bringing the patient from ward which accounts for 18% of cases (i.e.7 cases)because of the following reasons:

- Infrastructure problems- lift problems
- Unavailability of GDA
- To be admitted cases accounts for 10% of cases i.e.(4 cases)
- Whereas the rest of the causes have lesser effect on general first cases delay.

8.3.7 Other issues related to Operation Theatre

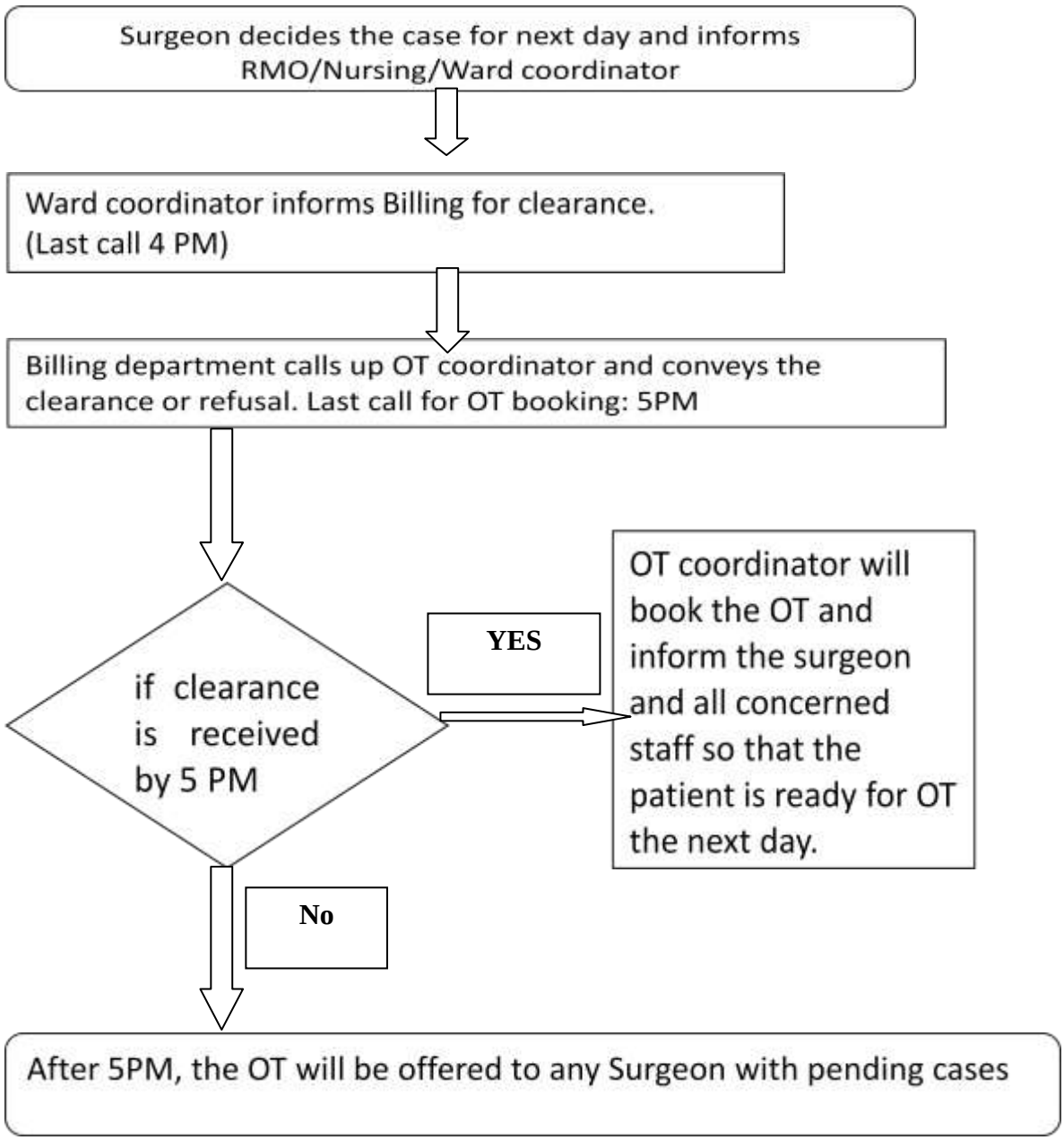
- **Pre anaesthesia check** up not done in 57% of cases (i.e.230 cases out 404 cases)
- **Incomplete site marking** form which is being filled in Operation theatre occurs in 55% of cases (i.e. 53 cases out of 97 cases)
- Allocated nurses do not accompany patients during his/her transfer to OT recovery.
- Operation theatre case list is not prepared till 6pm in the evening

8.4 PHASE IV: Improve

After doing the analysis we have come to know about the certain factors which are responsible OT case delay. To improve the current scenario following suggestions were given:

- All the cases or surgery should be started on the scheduled time so as to reduce the frequency of previous surgery delay which occurs due to the ripple effect of first cases
- A combined effort of medical team is required which includes both surgeons and anesthetists
- Patient from the ward should be called an hour before the scheduled time of surgery.
- To be admitted cases should not be posted as first case and they should be posted as second case.
- All surgeons who have the OPD timings on the same day of the surgery should scheduled their case with the gap of 30 minutes between the finishing time of OPD and scheduled time of the surgery so as to prevent change in schedule.
- All the investigations of the admitted cases should be done one day prior to surgery.
- In case of to be admitted patients all the investigations should be done on OPD basis.
- Operation theatre case list should be prepared till 6pm in the evening so that it can be send to wards and other departments

- Regarding office permission delays, a protocol can be initiated.



- Confirmation for the Implants one day prior to surgery
- No two surgeries which requires same kind of instruments should be scheduled back to back and should be scheduled alternatively.

8.5 PHASE V: Control

Implementation done on 5th May 2015 onwards:

- All the surgeries or cases have started scheduling at 8:00 am as before it was scheduled at 9:00 am.
- OT coordinator have started calling the patient from their respective wards one hour before the scheduled time of the surgery so that they can reach the OT recovery half an hour before the scheduled time of surgery
- To be admitted cases are not posted as the first case of surgery in Operation theatre
- Chairman has issued a circular on 5th May that bedside PAC should be done one day prior to surgery and OPD basis should be done before 5 pm in the evening.
- Nursing Superintendent has addressed the Nursing in charges of all the floors regarding nursing aspects related to OT handover and has ensured that only the allocated nurse will accompany the patient to OT recovery
- Office permission protocol is initiated..
- Post intervention data has to be collected to see the improvement and compare with the pre-intervention phase and to do comtinuous quality improvement.

9. References

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