

To Study Patient Throughput and Resource Utilisation in a Shared Endoscopy Centre of a Tertiary Care Hospital in India

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Abstract: *With the growing demand on endoscopic resources, achieving optimal efficiency has assumed increasing importance. The purpose of this study was to assess the efficiency of performing gastrology and pulmonary procedures in the common endoscopy unit in a large tertiary care hospital. Data were prospectively recorded for 112 procedures /patients: 96 gastrology procedures and 16 pulmonary procedures. The most common procedure was upper gi endoscopy (41.1). Overall, procedures for 24/64 or 37.4% of the patients coming to room 1 were delayed (≥ 15 minutes between procedures), because the physician was not available to start the procedure or delay in transfer the patient to post procedure room. The time elapsed between procedures was ≥ 30 minutes for 12 of the 24 delayed procedures (50%). Time and motion study revealed that 57 procedures were performed/week, with patients spending 135.5 min or 2hr 15 min at the endoscopy centre.*

Keywords: *Waiting time, Patient time inside procedure room, Procedure time, Turnover time, Recovery room time, History taking time, Sedation time, Manual washing time for endoscopes, Report writing time by doctor, Report writing time by nurse, Billing time, room 1, room2.*

Limitation: *Findings represent the experience of a single endoscopy unit in a tertiary-care centre and may not be generalizable to ambulatory surgical centres or other hospital-based endoscopy units. Factors other than procedure-time components may impact the efficiency.*

1. INTRODUCTION

There has been a dramatic rise in the request for gastrointestinal (GI) specialty care, and in particular endoscopic services in the last decade. This increase has been most notable in tertiary care hospitals whereby GI is one of the frequently requested specialty service. So there is a need to improve the efficiency and quality of endoscopic services. In this regard reducing variables like patient waiting time, procedure time, room turnaround time are of great significance. We should also look at the issue of hygiene while doing the procedure to bring quality.

So there is a need to develop more efficient endoscopy centres that can provide increased, high quality endoscopic services

while at the same time maximize patient satisfaction. Some studies have focused on altering staffing and utilizing additional staff in the pre-procedure process identifying bottlenecks in patient's recovery, reducing room turnover time, modifying patient arrival schedule or re-engineering patient towards improve efficiency and decrease patient stay. However, there are a number of limitations to many of these studies.

Our endoscopy centre uses shared personnel resources, equipment resources and space between gastro endoscopy and pulmonary procedures. This makes the need towards efficient utilization of resources even more important. It has got 4 consultants, 4 nurses and 2 other staff. Room 1 is allotted for gastro procedures, room 2 for broncho procedures.

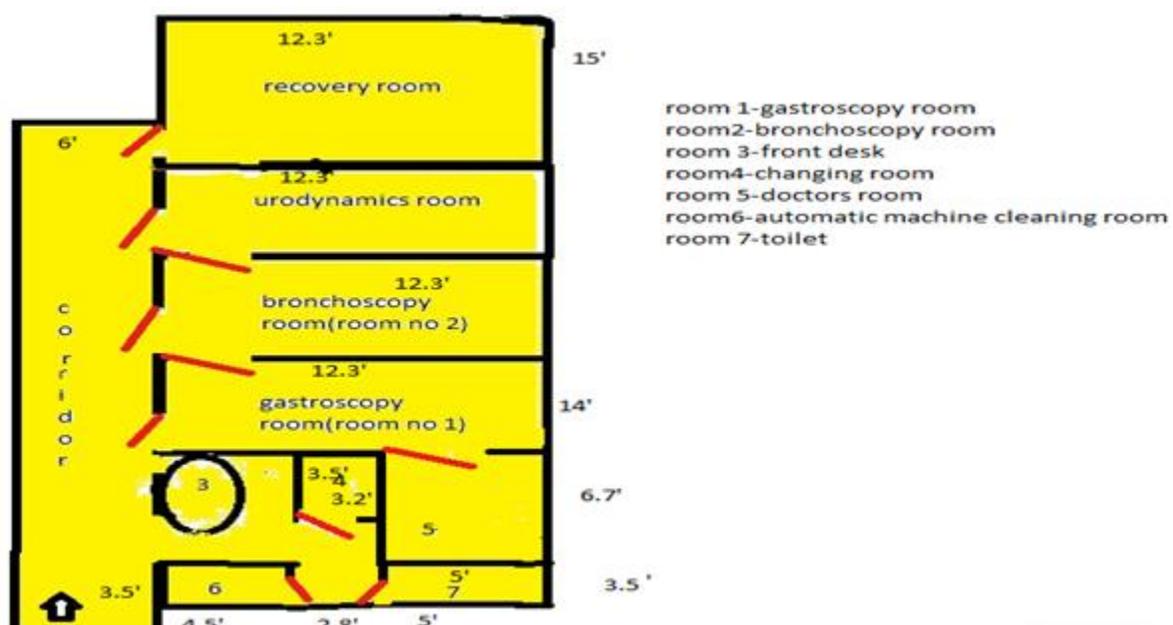


Figure 1 Layout of endoscopy department at the hospital

Table 1 Doctors schedule for OPD and endoscopy

Days	Doctors in endoscopy				Doctors in opd			
	d	a	J	g	d	a	j	G
Mon	8-2			2-4	4-6	1-3.30	12-4.15	3-6
Tue		8-2		2-4	1.30-2.45 ^f	4-6.30	9.30-11.30, 3-7 ^f	9.30-12.30, 2-6
Wed			8-2	2-4	4-6	3-4.30		10.30-2
Thu	8-2			2-4	4-6	1-3.30	10-1	9.30-12.30, 3-6
Fri		8-2		2-4	9.45-12			9.30-11.30 ^f , 5-7
Sat			8-2	2-4	2-4	9-11.30	2-4.30	9.30-12.30

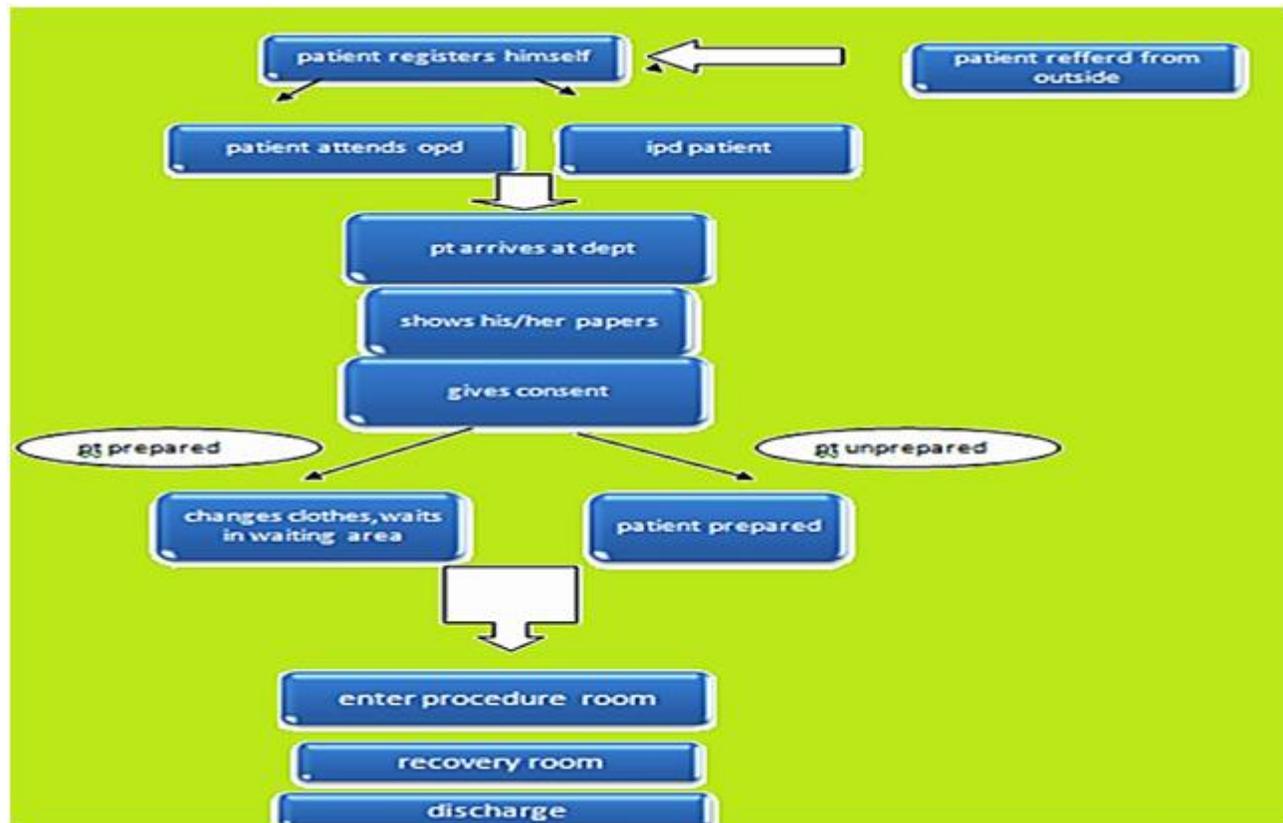


Figure 2 patient flow in endoscopy
Source- primary

2. REVIEW OF LITERATURE

Lukejohn W. Day and David Belson – In their study “Studying and Incorporating Efficiency into Gastrointestinal Endoscopy Centers” they critically review the history of efficiency in endoscopy centers, first by looking at other healthcare industries that have extensively studied and improved efficiency in their fields, examine a number of proposed efficiency metrics and benchmarks in endoscopy centers, and finally discuss opportunities where endoscopy centers could improve their efficiency.

Maged Dessouky PhD, Caitlin Hawkins, Michael Hogan, Lukejohn W. Day MD, David Belson PhD - In their study “Optimizing Efficiency and Operations at a California Safety-Net Endoscopy Center: A Modelling and Simulation Approach” they have tried to identify opportunities to

improve patient throughput while balancing resource utilization and patient wait times in a safety-net endoscopy center. A time and motion study was performed and a discrete event simulation model constructed to evaluate multiple scenarios aimed at improving endoscopy center efficiency.

3. OBJECTIVE AND SCOPE OF STUDY

3.1. Objective

1. To identify and address causes of delay
2. To identify opportunities to increase no of procedures by optimising resource utilization
3. To identify and address issues of quality
4. To assess efficiency in the endoscopy unit and to identify strategies to enhance efficiency.

4. RESEARCH METHODOLOGY

4.1. Research Design

Descriptive research study

Time motion study

4.2. Sample Design

Convenience sampling.

Consecutive endoscopic procedures were observed over the study period, and time intervals of the individual components of each procedure were recorded

4.3. Sample Size- 112 patients (96 gastro,16 broncho)

7 number of staff for focused group discussion

4.4. Setting: Study Setting

This study was conducted at a tertiary care hospital. The study site is a multi-specialty hospital in India.

4.5. Method

Time Motion Study (consecutive endoscopic procedures were observed over the study period(27 aug -16 sept) between 9 am- 5 pm, and time intervals of the individual components of each procedure were recorded.)

Focused group discussion with the staff

4.6. Source and Tool of Data Collection

A. PRIMARY DATA COLLECTION:

For doing the particular project the following primary data collection tools will be selected as suitable for the purpose-

Observation with checklist

Focused group discussion

B. SECONDARY DATA-

From endoscopy register book

OBSERVATION:

Under observation the information is sought by way of investigator's own direct observation without asking from the respondent.

In this study the researchers will prepared some checklist while doing observation and collected the necessary data by using those checklist.

4.7. Formula Used

WAITING TIME= $\frac{\text{sum}(\text{pt in time for consultation/procedure- pt reporting time in opd or diagnostics})}{\text{number of pts reported in opd or diagnostics}}$

(ref NABH Standards for hospitals 3rd ed)

4.8. Stastical Tools

The tools uses in this study will MS-EXCEL, MS-WORD. MS-EXCEL use to prepare pie- charts and graphs. MS-WORD was used to prepare or write the whole project report

4.9. Data Analysis Technique

Content analysis

4.10. Method Used to Present Data

Simple tabulation of data

Use of histograms

Use of pie charts

4.11. Ethical Considerations

This study was part of an on-going quality improvement project aimed at evaluating the performance of the endoscopy centre with respect to a patient's experience. Given our study was related to quality improvement, and no personal health information was collected at any time, formal institutional review was not required.

5. RESULTS AND FINDINGS

The most common procedure was upper GI endoscopy (41.1). Overall, procedures for 24/64 or 37.4% of the patients coming to room 1 were delayed (≥ 15 minutes between procedures), because the physician was not available to start the procedure or delay in transfer the patient to post procedure room. The time elapsed between procedures was ≥ 30 minutes for 12 of the 24 delayed procedures (50%).

5.1. Room Wise Analysis of the Data

Data collected between 27 August and 15 September 2015.

Table 2 statistics of room 1(gastro)

Total Gastro procedures in room 1	81
Avg room Turnover time	18 min
Avg waiting time	48.9 min
Avg time inside the endoscopy room	29.3 min

Room 2 (is mainly allotted for bronchoscopy, but few gastro procedures also done). Instead of turnover time it is better to look at the room utilization for room 2.

Table 3 statistics of room 2

Total procedures in room 2	33
So avg time/day when room 2 was used for procedures out of 480 min daily	90 min
Bronchoscopy waiting time	53.1 min
Avg pt time inside procedure room for broncho procedures	49.8min
Gastro waiting time	59.4 min
Avg pt time inside procedure room for gastro procedures is	42.2 min
Avg waiting time	56.5min
Avg patient time inside procedure room	46min
	Source-primary

Combining the data of room 1 and 2 we get-

Table 4 Stats of room 1 and 2 together

Total Gastro procedures in room 1,2	96
Avg waiting time(gastro)	50.2 min
Avg turnaround time(room 2 cases not taken)	18 min
Avg time inside the endoscopy room(gastro)	34.61
Recovery room time(for 20 gastro patients)	36.5 min
Billing time(for 15 gastro patients)	20.9min
total time spent in endoscopy dept	135 min
time between end of procedure and bill handing over to patient(data from 11 gastro patients)	15.7 min

Source- primary

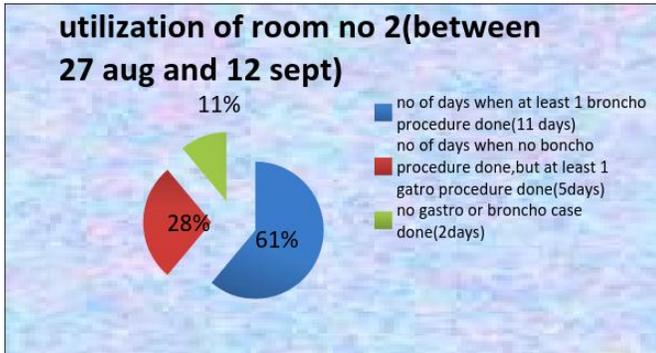


Figure 3 Room no 2(bronchoscopy room's) utility
Source-primary

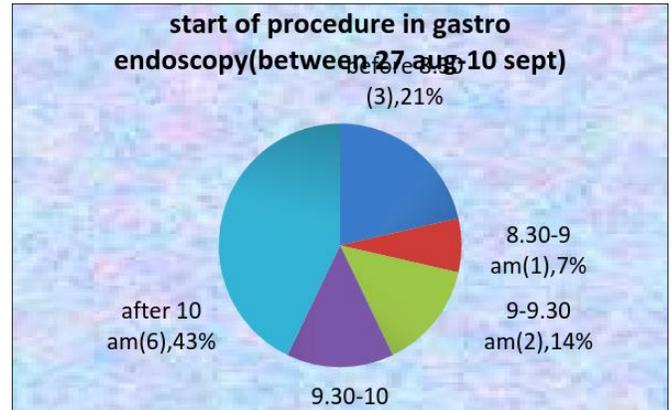


Figure 5- different time for start of 1st procedure of the day in endoscopy (gastro)
Source-primary

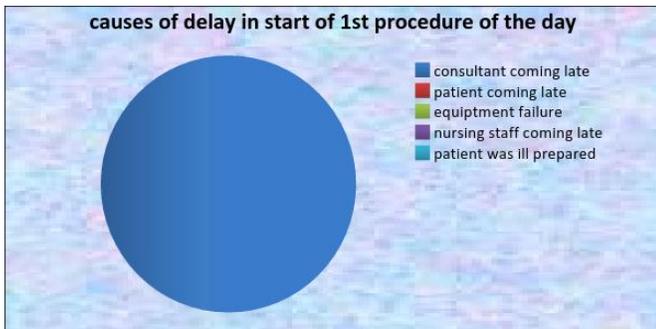


FIGURE 4- causes of delay during start of 1st procedure
Source- primary

Inference- From above figure we see that the sole reason of delayed start of procedure in the day is due to consultant coming late. Patient ill prepared for the procedure is a problem and this leads to increase in waiting time for the patient but this does not contribute to delay in start of procedure on other patient as there are always next patients available for endoscopy procedure.

Now if we look at the instances when endoscopy procedures started after 8.30 am then we find following results-

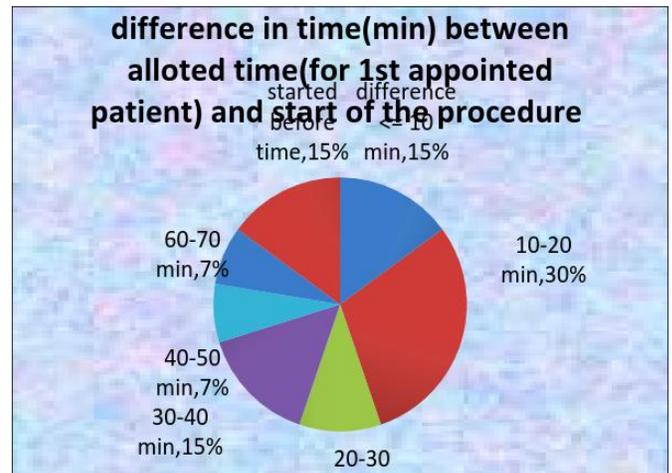


Figure 6-Difference between allotted time and start of procedure for 1st patient of the day (here in all cases the cause of delay is the consultant)
Source-primary

5.2. Pulmonary Procedures

More than 90% are bronchoscopy cases , next is pleural tapping.

No of cases between 27 aug to 16 sept 2015(3 weeks) = 16 cases

Avg no of pulmonary procedures per day=16/18=0.9 cases per day

Avg Waiting time =53.1 min

Avg procedure time= 49.8 min

5.3. Findings From the Focused Group Discussion

The focused group discussion was conducted among 7 employees of endoscopy department.

Table 6 Results of focused group discussion

staff	Endosc opy room	Recover y room	Preproce dure room	Staff chang ing room	Separ ate Space for scopes	Nurs e stati on	toilet	Cleani ng room	miscella neous
Dr.j	1	ok	No	-	yes(1)	Yes	Separate for staff	Be inside(1/2)	Changing room for patients
Nurse 1	1	bigger	“	Bigger(1)	Yes	“	“	“	-
Nurse 2	1	Bigger	“	Ok(1/2)	Yes	“	Ok(1/2)	“	More recovery beds
Nurse 3	1	Bigger	“	Ok(1/2)	Yes	“	Ok(1/2)	“	-
Nurse 4	1	Bigger	“	Ok(1/2)	Yes	“	Ok(1/2)	“	-
Wardbo y 1	1	ok	needed	Bigger(1)	Yes	“	Ok(1/2)	“	-
Wardbo y 2	1	bigger	Not needed	Ok(1/2)	Yes	“	Ok(1/2)	“	-

Interpretation- majority of them wanted Nurse station, bigger staff room, separate area for keeping scopes, cleaning room be inside, more recovery beds.

6. DISCUSSION/ ANALYSIS

The most common procedure was upper GI endoscopy (39.1%). Overall, procedures for 24/64 or 37.4% of the patients coming to room 1 were delayed (≥ 15 minutes between procedures), because the physician was not available to start the procedure or delay in transfer the patient to post procedure room. The time elapsed between procedures was

≥ 30 minutes for 12 of the 24 delayed procedures (50%). Time and motion study revealed that 57 procedures were performed/week, with patients spending 135.5 min or 2hr 15 min at the endoscopy centre.

6.1. Comparing with Benchmark

Benchmark is Taken from the Following Source

Gastroenterology Research and Practice Volume 2015, Article ID 764153, 9 pages, Hindawi Publishing Corporation <http://dx.doi.org/10.1155/2015/764153>

6.1.1. Operational Benchmarks

6.1.1.1. Pre Procedure Time (Waiting Time)

	benchmark	Gastro room 1	Gastro room 2	Overall gastro
Pre procedure time(waiting time)	3-22.3 min	48.9min	59.9min	50.8min

6.1.1.2. Procedure Duration

	benchmark	Gastro room 1	Gastro room 2	Overall gastro	Remark
procedure time	3-42 min	29.3 min	42.2	31.3min	Though within normal, but wide variation

6.1.1.3. Sedation Time (Mild)

	Benchmark	Gastro	remark
Sedation time	2.1-11.2 min	3.1	Though within normal but wide variation, sometimes even 1 minute

6.1.1.4. Room Turnover Time

	Benchmark	Gastro room 1	Gastro room 2	Overall gastro
Room turnover time	2-26.6 min	18 min		18min

6.1.1.5. Endoscopist Completing Paperwork after Procedure

	Benchmark	Gastro doctors paperwork only	Nurse's paperwork time	Total paperwork time per patient
Paperwork time	3-22.3 min	6.1 min	4.7min	10.8min

6.1.2. Productivity Benchmarks-

6.1.2.1. No of Procedures Per Room Per Day

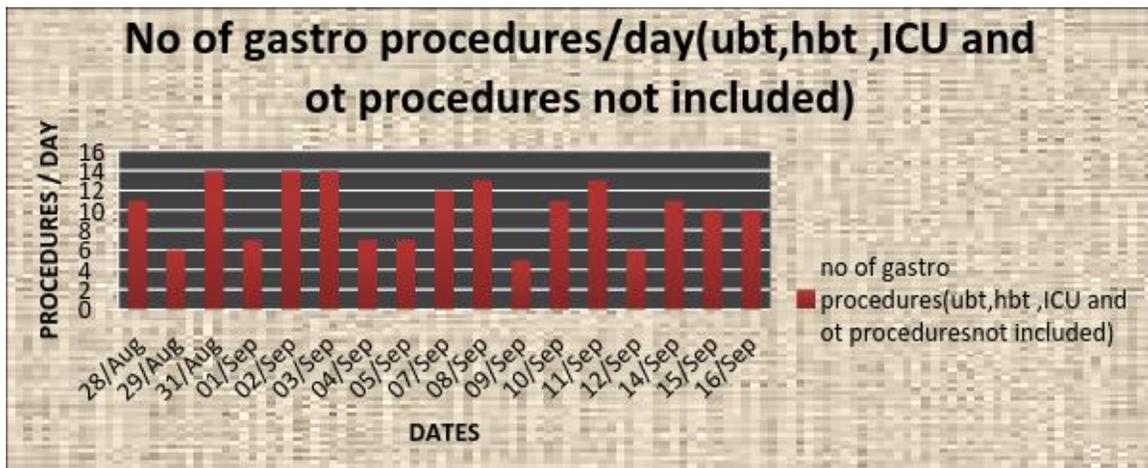


Figure 7 procedures per room
source- primary

Inference--Avg no of gastro endoscopic procedure per day is 10, which is less than the benchmark(14-16).

6.1.2.2. Room Utilisation Time

Total time including avg turnaround time and avg patient time inside procedure room=18+34.6=52.6 min.

So no of procedure that can be done in 1 room =11.4(between 8-6 pm).

Now @0.9 broncho procedures/day number of gastro procedures that can be done in room 2= $\frac{600-0.9 \times (\text{avg turnaround time}(18) + \text{avg procedure room time for broncho}(49.8))}{52.6}$.

=10.2 gastro cases can be done in room 2 per day.

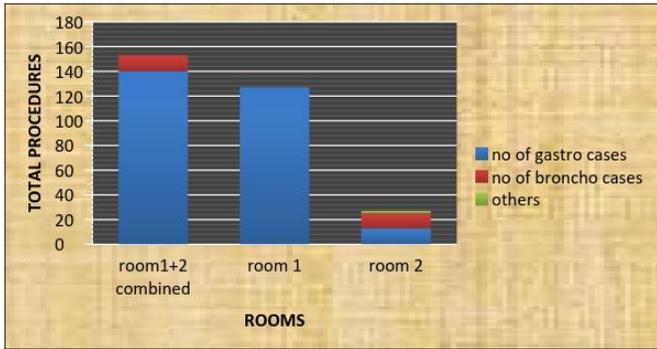


Figure 8 -Patient load/procedures in room 1 and 2(28 aug -12 sept)
 Source- primary

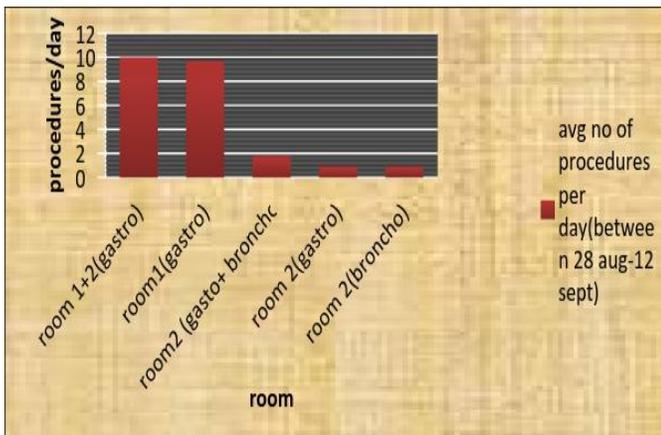


Figure 12 –total procedures/day in the period
 Source- primary

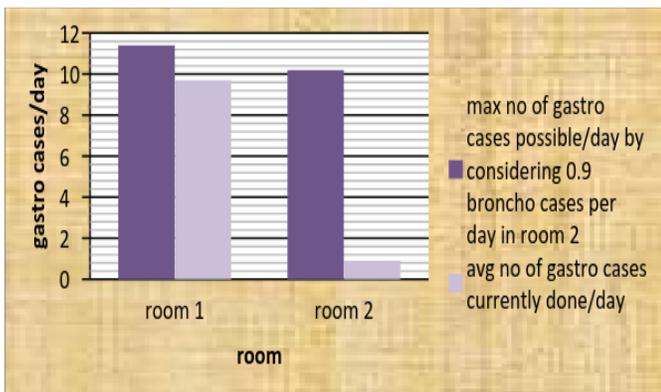


Figure 9-comparison between gastro cases done in room 1 and 2
 Source- primary

6.1.3. Facility Benchmarks-

6.1.3.1. No of Recovery Beds: Procedure Room

	benchmark	Gastro
no of recovery beds: procedure room	2-3:1	1:1 (assuming 1 bed each for gastro, broncho, uro)

6.1.3.2. No of Preprocedure Beds: Procedure Room

	benchmark	Gastro
no of preprocedure beds: procedure room	2:1	0

6.2. Productivity of The Department and Doctors in Gastro Endoscopy

6.2.1. Productivity of Department

Total 171 gastro endoscopy procedures done in 3 weeks
 Avg of 57 procedures per week
 Avg of 10 procedures per day

6.3. Analysing the Difference Between Procedure Time and Patient Time in Procedure Room

While procedure time defines only the time in doing procedure and excludes history taking time, sedation time etc, patient time in procedure room includes procedure time and time spent in other procedures like sedation time, history taking time etc.

We will look at the 16 patients who were observed between 9 sept to 16 sept for the above.

Procedure time=16 min

Patient time inside procedure room=34.9 min

Thus patient time inside procedure room is more than the double of procedure room.so there is huge scope of improvement.

6.4. Analysing the Delay and its Reasons

There are two types of endoscopy center delays: patient and procedure related. Patient related delays are due to walk in patients or ill prepared patients (due to inadequate instruction for preparation).

Procedure related delays are due to unavailability of doctors(if doctor has gone to opd or icu, ot).issue of doctor shuttling between opd and endoscopy effects both opd patients and endoscopy patients, further it leads to inefficient utilization of staff and endoscopy room.so the consultant should not come for endoscopy procedure in middle of opd hours, instead list of such walk in patients should be prepared and called to

endoscopy after the opd hours .This will allow the endoscopy staff to adequately prepare and allot time to patients. Further physician related delays are usually the result of lack of punctuality, multitasking and/or performing other tasks not related to endoscopy or in some cases endoscopists may exceed their scheduled procedure times when performing endoscopy. It is crucial to address these issues with providers, monitor and share this data with physicians, and have mechanisms in place to deal with physician behaviour.

Since most of the endoscopy procedures are not on emergency basis so the consultant should finish his appointed cases and then only he should take up cases in OT or ICU.

7. RECOMMENDATION

7.1. Recommendation Regarding Architectural Change in the Endoscopy Department

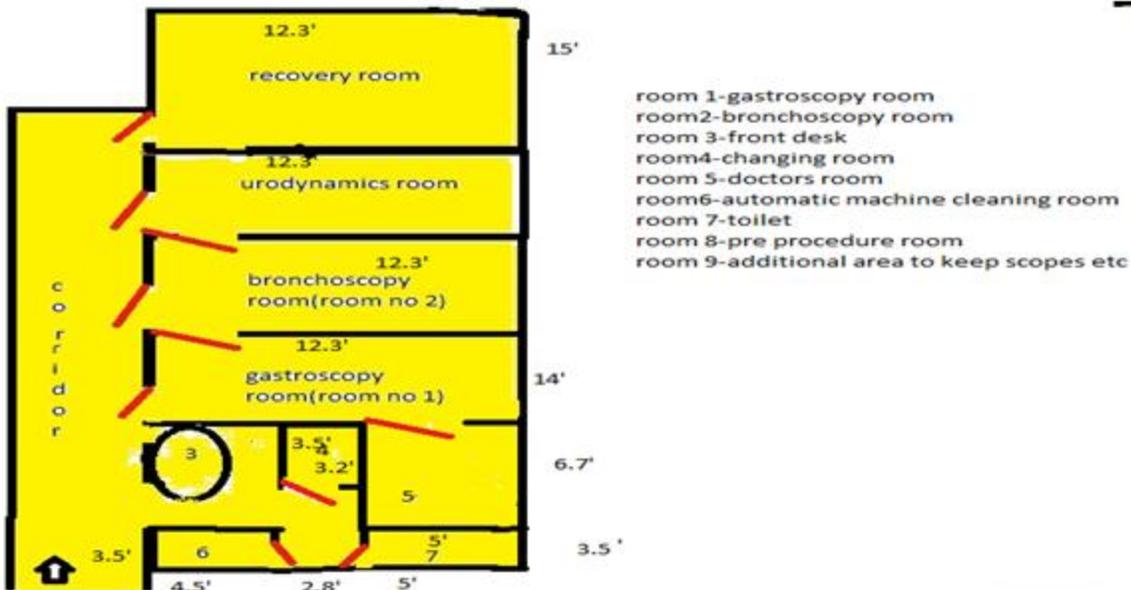


Figure 10 general layout of endoscopy dept

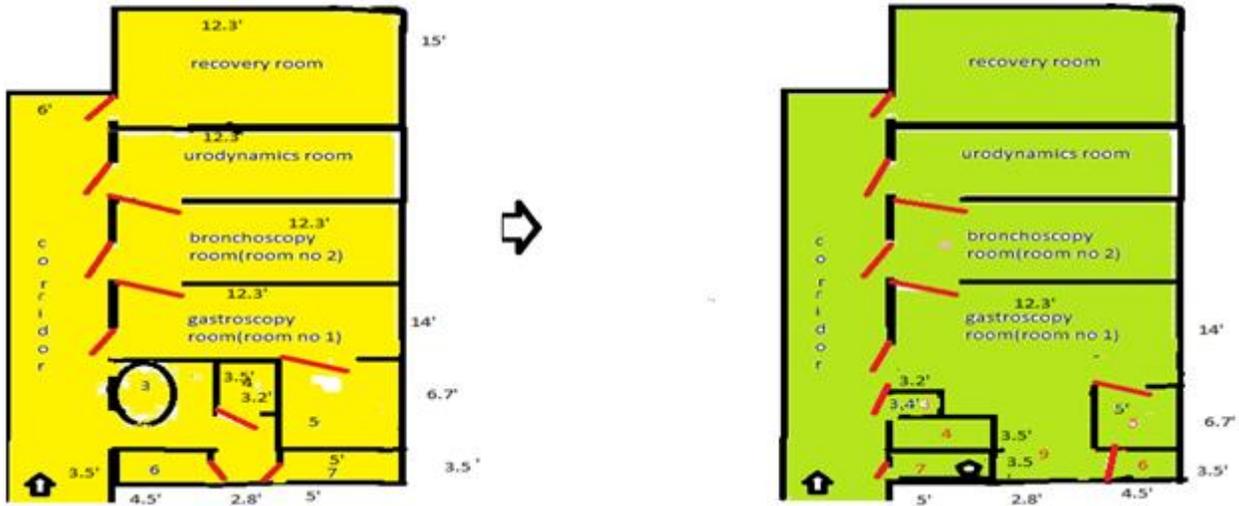


Figure 11 architectural plan

In option 3 I have tried to address the issues that were brought out in focused group discussion with the staff.-

a) need for a reception (nurse station)

b) need to take the automatic scope washing room inside the endoscopy room to maintain better hygiene

c) additional space for storage and upkeep of scopes

d) bigger changing room

Functional Areas	Current area(sq foot)	New area(option 3)(sq foot)
reception	$4.16 \times 2.9 = 12.08$	$3.2 \times 3.4 = 11.2$
Patient preparation/holding	0	0
recovery	$12.3 \times 15 = 185$	185
Procedure room	$12.3 \times 14 = 172.7$	172.7
Instrument processing room	$4.5 \times 3.5 = 15.8$	15.8
Scope storage	1 almirah	$7 \times 2.8 = 19.6$
Doctors room	$5 \times 6.7 = 33.33$	33.33
Miscellaneous(space between toilet ,changing room, reception)	40.66	
Changing room	$3.2 \times 3.4 = 11.2$	$5 \times 3.5 = 17.5$
toilet	$5 \times 3.5 = 17.5$	17.5
Total area(495.66)	488.29	472.63

7.2. Addressing Issue of Long Waiting Time

7.2.1. Cause of delay

Late start of 1st procedure of the day by consultant-when procedure was started after the allotted time to 1st patient of the day-11 out of 13 times (84.6%)

We see that the sole reason of delayed start of procedure in the day is due to consultant coming late. Though patient ill prepared for the procedure is a problem and this leads to increase in waiting time for the patient but this does not contribute to delay in start of procedure on other patient as there are always next patients available for endoscopy procedure.

7.2.2. Addressing Procedure Related Delays

There is a need for starting the procedure at allotted time and finishing it within stipulated time is important in order to reduce waiting time, procedure time and turnaround time. This will also help in increasing efficiency by taking more patients per room.

Display format OF T.V should be

s.no	patient name	type of patient(ipd/opd)	alloted time	if appointment taken	probable time of start of procedure	avg time for the procedure
1	Mr x	opd	9	yes	9.30	15 min
2						

I propose to install stop watch in endoscopy room.2 type of stop watch 1with 30 min as time limit for longer procedures like colonoscopy and one be set at 15 min for shorter procedures like UGI. Both watches should be of different colour and should be covered with transparent plastic. It should be kept over the CPU and the nurse who will be assisting the doctor should start on and switch off the stop watch.in this way the doctor will know if he has crossed the stipulated time.

Findings of the study describe Consultant as the main reason of delay that leads to longer waiting time for the patients.

So we need to inform consultant of the consequences of him not being punctual with respect to allotted time for the patients.

Further it was observed that most of the time even with respect to appointment time the appointment rarely starts at 8am (except patients of dr d) appointment slot starts sometimes even at 10 am and 10.30 am. So it leads to wastage of the morning slot. So since each of the 3 main doctors are allotted 2 days each every week so they should start procedure strictly by 8 am.

Also I propose the installation of 1 T.V monitor (21 inch) in room1 that displays the list of patients and their allotted time slots. Similar t.v monitor can be installed in the waiting area so that patient can keep track of their scheduled time and also change or delay in their appointment slot. Such information will greatly reduce the anxiety of patient even if he needs to wait .one nurse should take care of updating the display.

Regarding the waiting time of ipd patients it can easily be reduced by adequate coordination between the endoscopy staff and ward nurse. We can fix specific slots like 3-5 pm for ipd patients as by 2 pm most of opd cases finish.

7.3. Recommendations for Patient Related Delays

There are a number of interventions the endoscopy centre can employ to minimize patient related delays. These include

Ensuring that patient instructions are clear (both Hindi and English, and use of colours to highlight important ones, give online link to video in you tube regarding how to prepare oneself for procedure), performing an advance call to patients to review preparatory instructions/medications (thus making sure that they come prepared), and ensuring an efficient check-in process once the patient arrives at the endoscopy center, Send back those patients(opd appointment) who are not well prepared. Along these lines, a number of modalities can be used to improve patient adherence to pre-endoscopy instructions and reduce patient related delays.

7.4. Other Steps Than Can Help to Reduce Waiting Time, Procedure Time and Improve Efficiency

We can employ personnel to obtain prior intravenous access (when patient wait outside in the lobby). It will reduce the procedure time and thus improve the turnaround time by at least 2-3 min (as 2-3 min is the time taken by nurse to put iv line etc. inside procedure room)

Eliminating post procedure paperwork for the endoscopist by allowing the junior doctors to start making the report simultaneously while consultant does the procedure by noting down the findings on the already available format will reduce the report writing time of 6.1 min by doctor post procedure. once procedure ends the endoscopist can check the report written by the junior doctor that shouldn't take more than 2-3 min. This will further reduce the turnaround time by 2-3 min.

History taking is usually done inside the procedure room(takes 3.6 min per patient).this can be taken in the initial stages when patient arrives in the department(can be taken by junior doctor) and later he

can brief the consultant.it will help in reducing the procedure time by around 3 min.

The paperwork by the nurse also takes 4.7 min per patient. We can have a printed format of this and nurse can just sign it. It will also reduce the turnaround time.

Time between end of procedure and bill handing over to patient (gastro) is 15.7 min ,this also leads to unnecessary wait and anxiety for relatives of patient. This can easily be reduced by handing over the bill as soon as procedure ends. Since format is available so this should not be difficult to implement.(many relatives keep on enquiring about bill and sometimes become angry for delay)

7.5. Sedation.

I propose the use of Alternatives to propofol in consultation with the Consultants.

One of the suggestions were in form of combination of midazolam/fentanyl which was shown to reduce total procedure time (due to shorter induction-to-intubation time) for patients undergoing upper endoscopies. The decision should be taken by the consultants in the best interest of the patient.

7.6. Recovery Room.

Lastly, reducing recovery room time can help increase efficiency.

In normal average cases we should try to limit recovery room time to 30 minutes and not allowing patients to recover in a procedure room. This will help in procedure volume increase. This has to be taken care of by ward boy. Each patient be told that after 30 min they need to clear the bed (provided they are ok and effect of sedation has been reduced significantly)

In order to strictly follow this each bed be assigned with 1 stop watch alarm that will be started by the ward

boy whenever he brings a new patient to recovery room.

7.7. Effective Utilisation of Bronchoscopy Room

The room for bronchoscopy and other pulmonary procedures is utilized for only 1.5 hrs/day on an average. So most of the time it is unutilized. Further pulmonary cases are very few with average of less than 1(0.9) case per day. So the room is not able to generate enough revenue. On the contrary gastro endoscopy procedures are on the rise. So the broncho procedures should either be shifted to casualty or be allotted fixed slot like 9am-11am.

Room 1 be kept exclusively for only 1 consultant who is scheduled for that day. room 2 be kept for walk in patients of others.

7.8. Recommendations on the Issue of Personnel Utilization.

As noted earlier patient time inside procedure room is more than the double of procedure room .so by adequately using personnel resources it can be greatly reduced.

I have developed standardized work tasks for staff.

Table11 Assigning specific role to each staff in order to reduce waiting time-

<u>staff</u>	<u>New additional role</u>	<u>Impact</u>
Senior most nurse(nurse no 1)	Making the list of patients both appointment and walk in and make it display on the monitor for doctor and patient	Will streamline the flow of patients. will help to make consultants more accountable as patients know at what time they should be called.
Nurse assisting in procedures(nurse no 2)	Should on and off the stop watch at entry of patient and exit of patient from procedure room	Alarm will start ringing if the procedure takes more than stipulated time, thus will reduce patient time inside procedure room and thus will also reduce waiting time of subsequent patients
Ward boy	Should start the stop watch besides the bed of every patient in recovery room(set at 30 min)	
Nurse no 3	She will do all the paper work, instruct patients, give bill to patient	Will help to reduce duplication of work
Nurse no 4	She will be assisting w.r.t procedures in room 2	Will help towards better utilization of human resource

7.9. Issue of Extra Financial Burden Due to Above Suggestions

Since no suggestion for any extra staff so in terms of staff no extra financial burden. But in order to increase the throughput of endoscopy hospital needs to buy the following-

AUTOMATIC ENDOSCOPE CLEANING MACHINE-1 no-rs (not known)

T.V MONITORS- 2 nos- rs 30000 (aprox)

STOP WATCH-5 nos-5*500=2500

TOTAL- RS 32500

TABLE 2: Reported endoscopy center benchmarks based on reported literature.

Operational benchmarks	Esophagogastroduodenoscopy (EGD)	Colonoscopy
On-time procedure start (%) [22, 23]	53.3–75.0	55.0–75.0
Preprocedure time (min) [22, 24]	6.0–20.9	3.0–22.3
Procedure duration (min) [22, 24–26]	3.0–31.1	14.0–42.0
Sedation time (min)		
Moderate sedation* [22, 24–27]	5.0–10.0	2.1–11.2
Propofol [27–29]	2.1–3.6	2.1
Room turnover time (min) [22, 24, 26, 30]	3.0–26.6	2.0–26.6
Recovery room time (min)		
Moderate sedation* [22, 24, 26, 27]	9.1–50.2	14.0–61.0
Propofol [26–28, 31, 32]	3.4–15.0	14.3–18.0
Endoscopist completing paperwork after procedure (min) [24]	2.0	3.0

* Moderate sedation includes midazolam/fentanyl, midazolam/meperidine, and opioid alone.

TABLE 3: Reported endoscopy center benchmarks based on expert opinion.

Productivity benchmarks	
Number of procedures/room/day [33]	14–16
Number of patients/room/half-day	6
Personnel/staff benchmarks	
Number of physicians/room	1
Number of nurses/room [34]	1.5–2
Number of reprocessors per center	1–2
Equipment benchmarks	
Number of endoscopes: endoscopy room	2 upper endoscopes and 2 colonoscopes: procedure room
Mean time of reprocessing endoscopes (min)	30
Number of automatic endoscope reprocessors: procedure rooms [35]	1.5–2:1
Facility benchmarks	
Size of endoscopy room [34]	220/300 square feet
Number of recovery beds: procedure room [35, 36]	2–3:1
Number of preprocedure beds: procedure room [35, 36]	2:1

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