

## Effective utilization of time for non-operating room anaesthesia services at Aga Khan University Hospital Karachi: A prospective quality improvement audit

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### Abstract

**Objective:** To identify service quality gaps by reviewing out-of-operating-room anaesthesia services in a tertiary care hospital.

**Method:** This quality improvement audit was conducted at The Aga Khan University Hospital Karachi from July to September 2019, and comprised procedures conducted outside the operating room under anaesthesia and sedation from 8am to 5pm. A data collection form was designed to collect information related to the non-operating-room anaesthesia services. Data was analysed using SPSS Version 19.

**Results:** A total of 123 radiological procedures were observed in 48 working days and endoscopic/radio-therapeutic procedures observed were 98 over 31 days. The mean anaesthesia coverage time was  $2.96 \pm 1.71$  hours per day for radiological procedures, and  $2.59 \pm 1.07$  hours for endoscopic/radio-therapeutic procedures, indicating underutilisation of resources both human and material.

**Conclusion:** A multidisciplinary team consisting of all stakeholders should be developed to facilitate the patients and enhance healthcare quality.

**Keywords:** Non-operating-room anaesthesia, NORA, Radiological procedures, Monitored anaesthesia care, Multidisciplinary team. (JPMA 72: 1598; 2022)

**DOI:** <https://doi.org/10.47391/JPMA.3904>

### Introduction

Non-operating room anaesthesia (NORA) is a growing field with persistent increase in the number of performed procedures, include magnetic resonance imaging (MRI), computed tomography (CT) scan, endoscopy/endoscopic retrograde cholangiopancreatography (ERCP), transesophageal echo (TEE), cardio-version, electroconvulsive therapy (ECT), radiotherapy and brachytherapy. The anaesthesiologist, technicians, nurses and proceduralists must form a NORA team, with each member having a specific technical and administrative role in the design process, planning and operations of the NORA area in order to enhance patients' safety, as specific NORA procedures need specific expertise and equipment.<sup>1</sup> Anaesthesia or sedation services are necessary because the patient needs to tolerate the period of discomfort without moving during the procedure.<sup>2</sup> Deep sedation or anaesthesia is necessary for these procedures because little movement during MRI could cause prolongation of procedures through poor quality of imaging due to movement artefacts.<sup>2</sup> A contemporary trend analysis of NORA procedures showed that the proportion of patient with American Society of Anaesthesiology (ASA) III-V was higher in NORA group (37.6%) than in the operating room (OR) group

(33.0%) ( $p < 0.001$ ).<sup>3</sup> This trend suggests that the patients scheduled in NORA area must have a comprehensive preoperative anaesthesia assessment through a well-designed assessment and planning system.<sup>1</sup> In our tertiary care university hospital, these services are being provided by a team of anaesthesiologists, including two consultants and two trainees each day, except on weekends. Elective cases are performed from 8am till 5pm and the coverage for emergency cases is round the clock.

Delay or cancellation of procedures is an issue of healthcare quality and a major cause of waste of healthcare resources.<sup>4</sup> Cancellation of procedures and prolongation of hospitalisation cause anxiety, frustration, anger and inconvenience to the patients and their families.<sup>5</sup> A systematic review related to the patients' satisfaction concluded that generally patients are more satisfied with the professional skills and attitude of doctors and staff, while they are less satisfied with the hospital management, including waiting time and other environmental aspects.<sup>6</sup> The volume of cases in our hospital varies on a daily basis and the planning and coordination of these cases are currently not similar to OR surgeries under anaesthesia. There is no official well-coordinated comprehensive one-list-for-all arrangement for radiological, endoscopic, radiotherapy and other procedures requiring NORA and/or sedation, except the only list generated by the Radiology Department for its out-patients only. This list is generated by a Radiology

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official without the involvement of other related departments. There is no defined time slot for admitted patients in hospital, and that is why most of the radiological procedures requiring general anaesthesia or monitored anaesthesia care (MAC) get delayed. Regarding the endoscopic and electroconvulsive procedures, there is no proper mechanism of scheduling the cases according to their allocated time slots and patients' clinical conditions and the anaesthesia team remains unaware of these cases till the day of the procedure.

The current audit was planned to review the ongoing practice of NORA services and to identify service quality gaps.

## Materials and Methods

This quality improvement audit was conducted at Aga Khan University Hospital Karachi from July to September 2019, and comprised procedures conducted outside the operating room under anaesthesia and sedation from 8am to 5pm. Data was collected after permission from departmental research committee and the institutional ethics review board. Specific procedures were radiological procedures under general anaesthesia (GA) or MAC, endoscopic procedures under GA or MAC, transesophageal echocardiography under MAC, radiotherapy, brachytherapy and simulation procedures under GA. All emergency procedures, cases on weekends, those planned before 8am and after 5pm were excluded. A data-collection form was designed to collect information related to NORA services. The data collection form had two parts; part A was designed for the data of planned and actually done radiological procedures, and

part B was for the endoscopic, electroconvulsive and radiotherapy procedures. Written consent was taken from each anaesthesia consultant on NORA coverage. Each day before 8am, the forms were distributed by the investigators to the consultants on NORA duty. These forms were collected from the NORA team on a daily basis. The results of radiological procedures were drawn from the complete data collection forms of 48 working days, and the results of endoscopic procedures were drawn from the complete data collection forms of 31 working days. Incomplete forms were excluded. Median and mean procedure time under anaesthesia and/or sedation and turnover time was observed. Procedure time was defined as the time in hours and minutes, starting from the application of monitors to the patient for anaesthesia/sedation till the shifting of the patient to the postanaesthesia care unit, while the turnover time was defined as the time from the shifting of the patient to the postanaesthesia care unit to the start of subsequent procedure within one suite.

Data was randomly checked and stored in Microsoft Excel. Data was analysed using SPSS Version 19. All quantitative variables, like time in hours or minutes and daily potential time gaps among procedures, were expressed as mean and standard deviation. Time gaps were categorised into first half and second half of the day, and monthly frequencies of these gaps were presented by bar charts. Qualitative variables, like type of procedure, were described as frequencies and percentages.

## Results

A total of 123 radiological procedures were done in 48 working days. The radiological procedures included 104

**Table-1:** Median procedure time and turnover time among radiological and other procedures.

NORA Procedures	Number of NORA cases/working days	Median procedure time/day Median[25th-75th] percentile	Median turnover time among procedures/day Median[25th-75th] percentile
Radiological procedures	123 / 48 working days	2.67[1.57 - 4.00] hours	52.29[26.26 - 117.5] minutes
Electroconvulsive / Endoscopic Or Radiotherapy Procedures	98 / 30 working days	2.50[2.05 - 3.16] hours	51.88 [21.25-78.96] minutes

NORA: Non-operating-room anaesthesia.

**Table-2:** Mean anaesthesia coverage time.

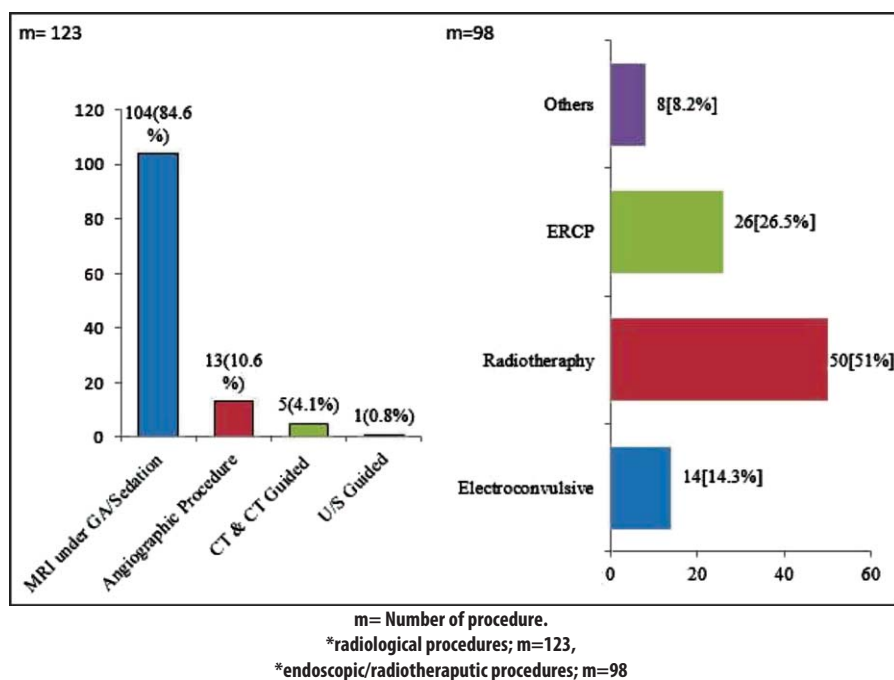
Span of time	Radiological Procedures		Endoscopic & other NORA procedures	
	Procedure time in hours/ day (mean SD)	Free time in hour/ day (mean SD)	Procedure time in hours/ day (mean SD)	Free time in hours/ day (mean SD)
≤1 h	0.93±0.12	7.07±0.12	0.61±0.43	7.39±0.43
>1h to ? 3h	2.15±0.59	5.85±0.59	2.28±0.44	5.72±0.44
>3h to ? 5h	4.18±0.60	3.82±0.60	3.75±0.68	4.25±0.68
>5h to ? 8h	6.20±1.09	1.80±1.09	-	-
Total	2.96±1.71	5.04±1.71	2.59±1.07	5.41±1.07

NORA: Non-operating-room anaesthesia, SD: Standard deviation.

**Table-3:** Average turnover time among NORA procedures.

Turnover time (minutes)	Radiological Procedures			Electroconvulsive & other NORA procedures		
	Observed working days	Number of performed procedures	Turnover time in minutes (mean SD)	Observed working days	Number of performed procedures	Turnover time in minutes (mean SD)
0 to 30	11	32	15.00±12.50	10	42	14.32±10.42
31 to 60	11	43	47.27±7.85	06	22	51.21±7.78
61 to 120	09	26	104.35±18.41	05	17	76.70±4.74
>120	05	10	250±37.42	05	12	156±26.78
Single procedure scheduled	12	12	-	05	05	-
Total	48	123		31	98	

NORA: Non-operating-room anaesthesia, SD: Standard deviation.

**Figure:** Non-operating Room Anaesthesia (NORA) Procedures during Audit Period.

(84.6%) MRIs under GA or sedation, 13 (10.6%) angiographic procedures, 5 (4.1%) CTs and CT-guided procedures and 1 (0.8%) ultrasound-guided procedures (Figure). The total endoscopic/radio-therapeutic procedures were 98. The proportion of endoscopic/radio-therapeutic procedures were 50 (51%) radiotherapies under sedation or GA, 14 (14.3%) electroconvulsive therapies, 26 (26.5%) ERCPs and 8 (8.2%) other endoscopic procedures.

The median turnover time among radiological procedures ranged 15-250 minutes. Out of total 48 days of observed radiological procedures, in 11 days the median turnover time was 15.00±12.50 minutes, in another 11 days it was 47.27±7.85 minutes, in 9 days it was 104.35±18.41 minutes, in 5 days it was 250±37.42 minutes, and the on the remaining 12 days only one

procedure was performed each day.

The median turnover time among endoscopic/radio-therapeutic procedures ranged 15-160 minutes. Out of 31 observed days, in 10 days the median turnover time was 14.32±10.42 minutes, in 6 days it was 51.21±7.78 minutes, in 5 days it was 76.70±4.74 minutes, in another 5 days, it was 156±26.78 minutes, while in the remaining 5 days, only one procedure was performed each day (Table-1).

The overall average number of radiologic procedures was 2-3 per day over 48 working days. In 8 working days an average of one procedure was done each day, in 21 working days an average of 2 procedures were done each day, in 14 working days an average of 3-4 procedures were done each day, and in the remaining 5 working days, an average of 4 procedures were done each day. The

mean procedure time across the 48 working days was 2.96±1.71 hours, or 177.6±102.6 minutes each day. The observed mean procedure time was 0.93±0.12 hours, or 55.8±7.2 minutes, in eight working days; 2.15±0.59 hours, or 129±53.4 minutes, in 21 working days; 4.18±0.60 hours, or 250.8±36 minutes, in 14 working days and in the remaining 5 working days, the mean procedure time was 6.20±1.09 hours, or 372±65.4 minutes.

In terms of of endoscopic/radio-therapeutic procedures, in three working days 1-2 procedures were performed each day, in 18 working days 2-3 procedures, and in 10 working days 4 procedures were performed each day. The observed mean procedure time in three days was 0.61±0.43 hours, or 36.3±25.8 minutes, in 18 working days 2.28±0.44 hours, or 136.8±26.4 minutes, and in 10 working days 3.75±0.68 hours, or 225±40.8 minutes). The

mean anaesthesia coverage time across 31 days was  $2.59 \pm 1.07$  hours, or  $155.4 \pm 64.2$  minutes (Table-2).

The average turnover time among the radiological and other procedures was categorised into four categories from 30 minutes to >120 minutes (Table-3).

## Discussion

The study found a significant wastage of time between the procedures. Total average time in which the radiological procedures were done was 3 hours a day and other procedures which required MAC took an average time of 2.5 hours per day.

Another important finding of the audit was that there was no organised single list of procedures other than the list of elective radiology cases under anaesthesia cover. The anaesthesia team which comprised two consultants and two residents was found to be underutilised basically because of lack of organised Structure. There was no organised list for MAC procedures, like radiotherapy, ERCP, ECT, etc., which usually resulted in poor planning for the cases and sometimes overlapping of two procedures resulting in delay, or sometimes cancellation of cases. One study about scheduling of NORA cases showed that due to the dispersed geographical settings and small number of cases, scheduling has been a challenge, which, if not managed properly, may lead to reduced patient and healthcare team satisfaction and overall efficiency.<sup>7</sup> This problem could be sorted out with the development of a multidisciplinary team of stakeholders, including physicians and administrative staffs from anaesthesiology, radiology, gastroenterology, radiation oncology and psychiatry department. The team will facilitate in organising a proper list for all NORA cases at least a day before the planned procedure. The list should also include dedicated slots from the urgent cases of admitted patients and patients coming from the emergency department. One study also concluded that the scheduling of NORA cases should be integrated into the electronic system used for OR to ensure proper assignment of personnel and scheduling. It would also help to improve the patients' appointment and coordination system.<sup>8</sup> This initiative obviously needs coordination among the departments and, finally, one person/manager level person should be given the responsibility of scheduling all cases on a daily basis which will also help to prevent overlapping of the cases and will reduce the patients waiting time and anxiety. It will also help to enhance the effective utilisation of resources, including human resources and radiology, endoscopy and radiotherapy suites in a busy hospital. In an organised way, effective utilisation of all resources

would be anticipated. At the same time, there is a need to have an add-on list depending upon the level of emergency cases which could be accommodated in between if possible. The mechanism of inpatients' booking with type and urgency should also be developed.

Relatively long turnover time was observed in both radiology and endoscopic/radiotherapy groups. It was observed that the high turnover time was due to case cancellation, postponement, delayed reporting in radiology suite, incomplete nothing per oral (NPO) status at the time of procedure and/or accommodating an inpatient procedure in between the booked outpatient procedure list. In endoscopic/radiotherapy procedures, long turnover time was mainly related to the approach of the anaesthesia team in three different suites along with similar reasons as mentioned for the radiological procedures. One common reason of high turnover time was delay in the transportation of inpatients from different units of the hospital, like from wards, private wing, intensive care units (ICUs) and emergency room to the radiology suite.

This audit would be an opportunity to expand the out-of-operating-room anaesthesia services in other tertiary care hospitals of Pakistan. The initiative needs financial, administrative, human resources and systems support. The first step in the development of NORA services would need assessment and feasibility assessment of all the included centres. Systems are required for proper assessment, anaesthesia fitness and booking of fit patients for the procedures. Making a multidisciplinary team of all stakeholders committed to coordinated work would be a cornerstone of the whole process. In addition to the initiation and running of new services, policymaking, implementation and regular quality assessment and evaluation of services are also required for improvement. A formal mechanism of regular "service evaluation(s)" should also be designed. Service evaluation is an essential component of better service provision and enhanced quality of care. The evaluation must be done from the end-users, the patients, as well as by patient attendants, clinical and administrative stakeholders on with regular half-yearly or yearly intervals.

The main limitations of the current study is that the duration of the audit was short, and it should have been of three to six months. Besides, the patients' perspective of satisfaction and convenience of healthcare services should also have been added.

## Conclusion

Increased consolidation of services, proper planning,

block scheduling, involvement of all stakeholders and leadership of anaesthesiologists can help to improve patient satisfaction and overall quality of care. There is a need to introduce a multidisciplinary team of stakeholders and a central electronic system for booking all the cases in a single list which should be finalised at least a day before the planned procedures.

**Disclaimer:** None.

**Conflict of Interest:** None.

**Source of Funding:** None.

## References

1. Wong T, Georgiadis PL, Urman RD, Tsai MH. Non-operating room anesthesia: patient selection and special considerations. *Local Reg Anesth.* 2020; 13:1-9.
  2. Melloni C. Anesthesia and sedation outside the operating room: how to prevent risk and maintain good quality. *Curr Opin Anaesthesiol.* 2007; 20:513-9.
  3. Nagrebetsky A, Gabriel RA, Dutton RP, Urman RD. Growth of nonoperating room anesthesia care in the United States: a contemporary trends analysis. *Anesthesia Analg.* 2017; 124:1261-7.
  4. Stavrou G, Panidis S, Tsouskas J, Tsaousi G, Kotzampassi K. An Audit of Operating Room Time Utilization in a Teaching Hospital: Is There a Place for Improvemen. *ISRN Surg.* 2014; 2014: 431740.
  5. Venkataraman S, Sriram K. Cancelled elective surgery: study in an Indian Corporate Hospital. *Indian J Surg.* 1997; 59:372-06.
  6. Li Y, Gong W, Kong X, Mueller O, Lu G. Factors associated with outpatient satisfaction in tertiary hospitals in China: A systematic review. *Int J Environ Res Public Health.* 2020; 17:7070.
  7. Warner ME, Martin DP. Scheduling the nonoperating room anesthesia suite. *Curr Opin Anaesthesiol.* 2018; 31:492-7.
  8. Dexter F, Xiao Y, Dow AJ, Strader MM, Ho D, Wachtel RE. Coordination of appointments for anesthesia care outside of operating rooms using an enterprise-wide scheduling system. *Anesth Analg.* 2007; 105:1701-10.
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