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Standardization of Anaesthesia Ready Time and reasons of delay in induction of anaesthesia

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Original Article

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Abstract

Objective: Anaesthesia-Ready Time (ART) is the time taken by the anaesthetist to provide sufficient anaesthetic depth for start of surgery. Our aim was to set benchmark timings for ART and compare it with our current practice.

Methods: Benchmark ART time of 15 minutes was set for American Society of Anesthesiologists (ASA) class I and II patients, 30 minutes for ASA III and IV patients, 20 minutes for spinal and 30 minutes for epidural anaesthesia. An additional 15 minutes was added for each invasive procedure.

Results: Three hundred elective cases were audited. Seventy eight percent of the cases were within benchmark timings. The main causes of delay included undergraduate students performing procedures (24.6%), teaching invasive lines to postgraduates (21.3%) and paediatric patients (16.4%).

Conclusion: The introduction of benchmark timings and its regular auditing can help standardize operating room

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Introduction

Anaesthesia-Controlled Time (ACT) is defined by Dexter et al as the sum of Anaesthesia-Ready Time and Anaesthesia Recovery Time during a surgical procedure.[1] Anaesthesia- Ready Time (ART) is the time when the surgical patient has a sufficient level of anaesthesia established to begin surgical preparation and remaining anaesthetic chores do not preclude positioning and further preparation.[2] It is calculated from the time of attachment of monitors to the patient to the declaration by the anaesthetist that the patient is ready for surgery. Anaesthesia-Recovery Time starts when the dressing is finished and ends when the patient leaves the operating room.[1] Anaesthetists take variable time to anaesthetize a patient. This time depends on many factors e.g. the number of invasive procedures to be performed and ease of doing these procedures. This variable duration of induction has implications not only for the surgeons but also on patients as it prolongs operating room stay of patient and has economic implications especially where costs are not covered by a third party like insurance companies or national health schemes. This issue becomes more important in hospitals where no separate induction room is available.

Literature does not suggest any standard or benchmark times for different anaesthetic procedures. The objective of this audit was to evaluate and standardize the Anaesthesia Ready Time for different anaesthetic procedures and to identify the causes of delays in our anaesthetic practice.

Methods

The audit did not require ethical approval from the Human Subjects Protection Committee according to our institutional standards. A pilot audit was conducted to propose benchmark timings for different anaesthetic procedures. Opinion was also sought from consultants within the department. Three hundred patients were enrolled in the audit. Following benchmark times were used; fifteen minutes for induction of patients labeled as American Society of Anesthesiologist (ASA) class I and II patients and thirty minutes for ASA III and IV. Fifteen minutes were proposed as Anaesthesia-Ready time for spinal and twenty minutes for an epidural. Additional fifteen minutes were set for each invasive procedure like rterial line or central venous line insertion. Only patients undergoing elective procedures were included in the audit. Patients undergoing emergency and cardiothoracic surgeries were excluded. Convenient sampling was done and a form (Appendix) was distributed among anaesthetists working in different operating rooms. This form had entries about patient identification, surgical procedure to be performed, ASA grading of the patient, type of anaesthesia, presence of anaesthesia consultant at induction in addition to the resident, medical

student present at induction, number of procedures performed and total time taken for induction of the patient including time taken for invasive lines if any. Anaesthesia-Ready Time was recorded from the time when the monitors were attached to the patient to the time when the patient was declared to be ready for surgery by the anaesthetist. Seventy five percent of the patients, meeting the benchmark, was taken as an acceptable standard of performance. This cut off percentage was chosen arbitrarily after a consensus since no reference values were available.

Data was collected in the main operating suites, surgical daycare and obstetric operating room. Time of application of monitor, intravenous cannula insertion, anaesthetic drugs administration and the time when patient was declared ready for surgery was also noted on the form. Primary anaesthetist was asked to write comments if the anaesthesia ready time exceeded the benchmark time and identify the problems which prolonged the anaesthesia-ready time.

The results of the audit were discussed in the departmental quarterly audit meeting. A follow up audit, with fifty patients, was repeated after nine months and results were compared with the earlier audit.

Results

Three hundred audit forms were collected. One form had missing data leaving 299 valid forms. Forty four percent patients (n=131) were ASA I, 45% (n=133) were ASA II, 9.7 % (n=29) were ASA III, 0.7% (n=2) were ASA IV and in 5 patients ASA level was not mentioned on the forms. The surgical distribution of these patients is given in Table 1. In 75% of the cases (n=225) anaesthesia consultant was present at the time of induction in addition to the resident. In 25% of the cases (n=75) a medical student was involved in learning intravenous access, face- mask ventilation, laryngeal mask insertion or tracheal intubation. Two hundred and sixty three patients (80%) received general anaesthesia, 12 patients (4%) received spinal anaesthesia and 8% had multiple invasive procedures performed. General anaesthesia was combined with caudal in 13 paediatric patients (4.3%) and combined general and epidural was administered in 6 patients (2%).

On comparison of actual induction time with the predefined benchmark timings overall percentage of the patients who had Anaesthesia-Ready Time within benchmark time was 78.3%. The breakdown of this data based on ASA status is given in Table 2.

The main causes which lead to delay in induction, were the presence of an undergraduate student during the procedure, teaching of fiberoptic intubation and other invasive procedures to anaesthesia residents, paediatric patients and

Table 1. Surgical specialty distribution of audit patients.

Surgical Specialty	No.	%
Orthopaedics	83	27.8
General Surgery	58	19.4
Gynaecology/Obstetrics	36	12
Urology	29	9.7
Paediatrics	26	8.7
E.N.T.	25	8.4
Neurosurgery	14	4.7
Plastic Surgery	14	4.7
Dental Surgery	7	2.3
Eye	2	0.7
Not mentioned	5	1.6

Table 2. Comparison of Anaesthesia Ready Time (ART) with the preset benchmark time based on American Society of Anesthesiologists (ASA) grouping.

ASA Status	Total number of patients	Patients with ART within benchmark time n (%)	Patients with ART exceeding benchmark time n (%)
I	131	108 (82.4)	23 (17.6)
II	133	98 (73.7)	35 (26.3)
III	29	27 (93.1)	2 (6.9)
IV	2	1 (50)	1 (50)

Table 3. Anaesthesia-Ready Time: Reasons for exceeding benchmark.

Reasons	No. of patients
Medical student performing a procedure	15 (24.6)
Teaching invasive lines to postgraduate student	13 (21.3)
Paediatric patient, line placement, caudal etc.	10 (16.4)
Teaching fibreoptic intubation to post graduate student	5 (8.2)
Difficult intravenous access	5 (8.2)
Unanticipated difficult intubation	4 (6.6)
Difficult epidural	3 (4.9)
Patient photograph requested by the surgeon	1 (1.6)
Surgeon leaving the operating room after intravenous line insertion	1 (1.6)
Patient vomited before induction	1 (1.6)
Change of tracheal tube	1 (1.6)
Desired height of block achieved late after spinal	1 (1.6)
Faulty equipment	1 (1.6)

difficulty in performing epidural or tracheal intubation. In one case a photograph was requested by the surgeon after the attachment of monitors and in another case delay occurred because the operating surgeon left the room after insertion of intravenous line by the anaesthetist (Table 3).

A follow up audit was conducted nine months later. Fifty patients were audited. Eighty percent of the patients (n=40) had anaesthetic induction completed within benchmark timings and in patients where the benchmark timings had exceeded, the causes of delay were similar to those found in the initial audit. These included paediatric patients, difficult spinal and epidural and undergraduate student participating in induction.

Discussion

Efficient and smooth running of the operating rooms helps control total cost of the procedure and standardization of the operating room booking time. Delays in the start and completion of a procedure result in increased operating room stay of the patient as well as prolongation of overall scheduled list duration and at times postponement of other cases to the next day.[3,4] One of the factors, responsible for this delay, is the variation in time taken by the anaesthetists for induction of patients.

This audit was an attempt to focus on the standardization of time taken for anaesthetic induction in different anaesthetic procedures so that a standard anesthesia-controlled time can be taken into account for scheduling the cases. This would help smooth running of the operating rooms, completion of the cases within allotted time and efficient time management of operating room staff including surgeons, anaesthetist and technicians. This audit also attempted to identify the causes of variation and time taken by different anaesthetist and analyses of factors whereby correctible causes leading to undue delay could be rectified.

The benchmark timings for different anesthetic procedures were taken based on the experience and observation of the anaesthetists working in a university department. These benchmark timings can be different for different hospital settings and conditions.

We are unable to comment on whether the benchmark timings were too generous as no previous data is available on this issue. The benchmark timings, however, represented a consensus among anesthetists at one institution. We do not have the facility of separate induction room, the presence of which can expedite the process of anesthesia but at the expense of duplicating monitoring. Physical transfer of anaesthetized patients itself caries certain risks including profound unrecognized hypotension, cardiac arrest and awareness.[5,6]

Twenty eight percent of the patients belonged to the orthopaedic speciality followed by general surgery, gynaecology and obstetrics (Table 1). This distribution reflects the contribution of different surgical specialties in over all operating room workload in our institution.

Eighty nine percent of the patients included in the audit were ASA 1 and ASA II (Table 2). This does not reflect the actual case mix based on ASA classification at our institution where the proportion of ASA III and IV patients is much higher. This proportion may represent a sampling bias as most of teaching of the undergraduates and postgraduates is done on ASA I and ASA II patients. The smaller contribution of ASA III and IV patients may be due to a higher level of involvement of the anaesthetists in the management of these relatively sicker patients and not finding time to note the timings and filling the form.

Reasons of delay in cases where Anaesthesia-Ready Time exceeded benchmark timings could be divided into correctable causes and causes where a variable time was justified. The correctable causes included teaching material e.g patient photograph request by the surgeon, faulty equipment and surgeon leaving the theatre after induction. Reasons where a time limit could not be guaranteed, difficulty was encountered in establishing intravenous access in paediatric patients, an unforseen difficult central venous access or intubation. The teaching of the undergraduates and postgraduates was found to be the main reason for delay in 33 patients (54.1% of the delayed cases). This factor needs to be taken in account in making operating room schedules in teaching hospitals. Overdyk et al have also identified ART as an important factor in making successful strategies for improving operating room efficiency at academic institutions.[7] A time limit can also be proposed for such teaching activities. We plan to share these findings with our operating room committee and with the surgical department.

This audit had another extended role. At our institution, some subsections are now using this benchmark as a quality improvement tool within their own subspecialty like cardiac anaesthesia and neuroanaesthesia.

There is paucity of literature on this aspect of operating room management and there seems to be a need for further research.

In conclusion, Anaesthesia-Ready Time (ART) was found to be a useful audit tool to be used in anaesthesia departments with implications for improvement in operating room efficiency, utilization and eventually reduction in patient costs.

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Appendix

ANAESTHESIA READY TIME

Form No. _____

1. Medical Record No. _____
2. Surgery/Specialty _____/_____
3. ASA level with reason I II III IV V

   _____
4. Level of resident / medical officer present at induction I II III IV
5. Anaesthesia Consultant present at induction Yes No
6. Medical Student present at induction Yes No
7. Type of Anaesthesia / Procedure

   General Anaesthesia (G/A) Spinal Epidural

   G/A with Epidural Arterial line Central venous line

   Swan ganz catheter G/A with caudal
8. Time

   a. When first monitor applied ----------

   b. When Intravenous cannula inserted ----------

   c. When first induction drug given----------

   d. End of induction (Patient declared ready for surgery) ----------

Comments (Reason if induction time exceeds benchmark time)