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ORIGINAL RESEARCH EMERGENCY ANESTHESIA

Anesthesia ready time for emergency surgery at the 24-hour operating room of the central surgical installation in a tertiary hospital in Indonesia

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ABSTRACT

Background: Anesthesia Ready Time (ART) is the time required by an anesthesiologist, calculated from the time the monitor is placed on the patient until the patient is declared by the anesthesiologist to be ready for the surgery. ART varies based on the patient's ASA classification, equipment availability, preoperative invasive procedures, drug preparation, and waiting for the surgical team. The aim of this study was to determine the ART of patients undergoing emergency surgery and identify the affecting factors at a tertiary hospital in Indonesia.

Methodology: Samples were collected from patients consulted for emergency surgery at the 24-hour Central Operating Room of a tertiary hospital in Indonesia from August 2023 until February 2024, that included 116 patients. We used consecutive sampling and non-probability data collection methods.

Results: Overall, in 91.4% of cases, ART complied with the standards, with an average of 14.22 min. All regional spinal procedures met the standard, while general anesthesia procedures achieved the standard by 98.46%. The lowest ART rate was for regional epidural procedures, at 30.76%. Based on ASA status, only samples with ASA status 3 achieved a 100% compliance rate. While samples with ASA status 1 achieved 88%, and ASA status 2 achieved 89.7%. Several causes influenced prolonged ART in 8.6% of cases. Difficulty with the anesthesia procedure was the most common (60%), followed by waiting for the surgical team (30%), and monitor malfunction at 10%.

Conclusion: Anesthesia ready time in our tertiary hospital in Indonesia is satisfactory. Factors found to influence prolonged anesthesia ready time were mostly correctable ones.

Keywords: Anesthesia; Anesthesia Ready Time; ART; Emergency Surgery

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1. INTRODUCTION

Anesthesia services for emergency surgery aim to provide adequate anesthesia to patients who require immediate surgery. Emergency surgery defined as a case where surgery must be performed within 1 hour. Patients who have to undergo emergency surgery have a 10-fold higher risk of experiencing complications both preoperatively, intraoperatively or postoperatively.[1] Anesthesia Ready Time (ART) is the time required by an

anesthesiologist calculated from the time the monitor is placed on the patient until the patient is declared ready by the anesthesiologist for surgery.[2,3] In several hospitals in developed countries in the world, ART time in large hospitals and teaching hospitals with ART time> 30 min ranged from 7%, while the international limit time is less than 45 min.[3,4] ART has different benchmarks based on the ASA classification of the patient and procedures performed on the patient. Patients with ASA I-II have an ART of about 15 min, ASA III and IV have an ART of about 30 min and 15 min for SAB, 20 min for epidural procedures and an additional 15 min if invasive procedures are performed. The benchmark was set by a similar study in Pakistan. American Society of Anesthesiologists (ASA) Physical Status Classification is a system for anesthetists to assess and communicate a patient's pre-anesthesia medical co-morbidities, and it can be helpful to predict perioperative risks. ASA recognized patients into 6 categories: ASA I (a normal healthy patient), ASA II (a patient with mild systemic disease), ASA III (a patient with severe systemic disease), ASA IV (a patient with severe systemic disease that is a constant threat to life), ASA V (a moribund patient who is not expected to survive without surgery), and ASA VI (a declared brain-dead patient).[2,4] Many factors can affect ART such as problems with monitoring devices, ECG, tension, saturation, installation of invasive anesthesia procedures, preparation of DC shock, preparation of anesthetic drugs, patient positioning, listening to fetal heart rate in obstetric cases, waiting for surgical team according to their fields, and preparation of surgical instruments. The many factors can be grouped into 4 simple categories to facilitate the identification of factors that affect ART, these factors are: man, machine, method and environment.[4,5]

Objective of study

The identification of factors affecting ART in a tertiary hospital in Indonesia is the beginning step to improve the effectiveness and productivity of the operating room so as to obtain sufficient quality of anesthesia and appropriate surgical management of patients in order to reduce patient morbidity and mortality both preoperatively, intraoperatively or postoperatively.

2. METHODOLOGY

The subjects of this study were all patients who underwent emergency surgery in the 24-hour operating room of the tertiary hospital in Indonesia filled by anesthesia resident doctors on duty from August 2023 to February 2024 who fulfilled the inclusion and exclusion criteria and were willing to participate in the study after being given an explanation and signing an informed consent form. The inclusion criteria were all patients who were consented to undergo emergency surgery in the 24-hour operating room of the tertiary hospital. Exclusion criteria were patients with ASA 5, patients who have been intubated before induction, patients who underwent surgery with local anesthesia, and patients whose surgery were canceled. All samples that have met the inclusion and exclusion criteria will be included as research subjects. Data were collected prospectively from August 2023 to February 2024 until the minimum total number of samples was met.

After obtaining approval from the Research Ethics Committee at the authors' institution, the researchers determined the sample according to the list on the surgery schedule in the 24-hour operating room. Subject data was kept confidential to the researcher and all subjects were priorly given an informed consent form to be included in the study. Determination of subjects who became research subjects by consecutive sampling method, which is a a sampling technique in which every subject meeting the criteria of inclusion is selected until the required sample size is achieved. Recording starts from the beginning of the patient being admitted to the operating room by observing whether intravenous access, which is a fluid line to the peripheral vein, is available or not. If intravenous access was not available, the start and end time of intravenous access was recorded. The subjects then underwent preoperative anesthesia service procedures, ART time was recorded starting from the time the patient was placed on a monitor in the operating room, the time when the anesthetic action used began and the time when the patient was declared finished with anesthesia induction and then preparation for surgery could be carried out. If there was a delay in the timing of the anesthesia action performed, the factors causing the delay were recorded. Preparation of anesthesia drugs and equipment was done before time recording as a minimum standard for all patients undergoing anesthesia.

3. RESULTS

The study analyzed anesthesia services from 116 emergency surgeries at a tertiary hospital in Indonesia. This study was a prospective study that started from August 2023 to February 2024 after the entire minimum sample size was met, in accordance with the inclusion and exclusion criteria. There were no study samples that were excluded.

Table 1 provides a comprehensive overview of the characteristics of the study subjects. This data provides useful insight into the distribution of relevant variables in the study population. Of the 116 study subjects, the distribution of male and female subjects was comparable at 58 (50%) each. The mean age of the patients was 36.76 y (SD ± 19.04 with the highest percentage in the 20-39 y age group (44.0%), followed by the 40-59 y age group

(29.3%). From the characteristics of ASA physical status, most of the patients were ASA II (58.6%), followed by ASA I (21.6%) and ASA III (19.8%). There were no study subjects with ASA IV or ASA V classification. The most common type of anesthesia was general anesthesia (56.0%), followed by regional-spinal anesthesia (SAB) (32.8%) and regional-epidural (11.2%). Obstetrics & Gynecology procedures accounted for the most emergency surgeries (29.3%), followed by Gastrointestinal Surgery (15.5%) and Urology (12.9%) which were almost equal.

Table 1: Overview of the characteristics of the study subjects

Variables		N (%)
Gender	Male	58 (50)
	Female	58 (50)
Age (Mean ± SD)	0-9 yr	11 (9.5)
	10-19 yr	8 (6.9)
	20-39 yr	51 (44.0)
	40-59 yr	34 (29.3)
	≥60 yr	12 (10.3)
ASA Status	ASA I	25 (21.6)
	ASA II	68 (58.6)
	ASA III	23 (19.8)
	ASA IV	0 (0.0)
	ASA V	0 (0.0)
Type of Anesthesia	General Anesthesia	65 (56.0)
	Regional - Epidural	13 (11.2)
	Regional - SAB	38 (32.8)
Type of Surgery	Pediatric Surgery	9 (7.8)
	GIT Surgery	18 (15.5)
	Plastic Surgery	7 (6.0)
	Neurosurgery	8 (6.9)
	Vascular Surgery	8 (6.9)
	Obstetrics & Gynecology	34 (29.3)
	Orthopedic Surgery	9 (7.8)
	ENT/HN Surgery	8 (6.9)
	Urologic Surgery	15 (12.9)

Results showed that the mean monitor insertion time was 3.39 min (SD ± 0). The mean induction duration was 10.83 (SD ± 1.69), while the mean invasive procedure time was 13.17 min (SD ± 3.11). The overall Anesthesia Ready Time (ART) was 14.22 min (SD ± 1.83). Of the procedures, most (91.4%) ARTs were benchmarked, while 8.6% of cases did not meet benchmarks from previous studies, with factors noted in the questionnaire (Table 2).

Table 2: ART component and compliance

Anesthesia Ready Time (ART)	Mean ± SD
Monitor insertion (min)	3.39 ± 0.92
Induction duration (min)	10.83 ± 1.69
Invasive procedure duration (min)	13.17 ± 3.11
Anesthesia Ready Time (ART) (min)	14.22 ± 1.83
Compliance of ART:	**N (%)**
Compliant with the benchmark	106 (91.4)
Not compliant with the benchmark, with factors (noted in the questionnaire)	10 (8.6)

The average ART time differed by anesthesia procedure (Table 3). The lowest mean ART time was recorded in the SAB regional anesthesia type at 13.65 min (SD ± 0.91) followed by the general anesthesia procedure with a mean time of 13.77 min (SD ± 1.52). Epidural regional anesthesia type had the highest ART time with a mean of 20.77 min (SD ± 1.48).

Furthermore, each type of anesthesia was analyzed in more detail based on ASA (American Society of Anesthesiologists) status. Only in the general anesthesia type group, patients had three ASA statuses, 1 to 3. Whereas in the type of regional anesthesia SAB there were no patients with ASA 1 status and in Regional Epidural there were no patients with ASA 3 (Table 3).

Table 3: ART differences from the average by anesthesia type

Anesthesia Type	ASA PS	Mean ± SD (min)
General Anesthesia (13.77 ± 1.52)	• 1	13.36 ± 1.21
	• 2	13.81 ± 1.33
	• 3	14.25 ± 2.04
	• 4	NA
Regional SAB (13.65 ± 0.91)	• 1	NA
	• 2	13.65 ± 0.95
	• 3	13.71 ± 0.75
	• 4	NA
Regional Epidural (20.77 ± 1.48)	• 1	21.00 ± 0.00
	• 2	20.70 ± 1.70
	• 3	NA
	• 4	NA

Data presented as mean ± SD

able 4: Characteristics and ART in samples with prolonged ART

Variables		N (%)
Gender	Male	9 (90)
	Female	1 (10)
Age (40.00 ± 20.00)	0-9 yr	1 (10.0)
	20-39 yr	4 (40.0)
	40-59 yr	3 (30.0)
	≥ 60 yr	2 (20.0)
ASA Status	ASA I	3 (30.0)
	ASA II	7 (70.0)
Anesthesia type	General Anesthesia	1(10.0)
	Regional - Epidural	9(90.0)
	Surgery Procedure	
	Plastic Surgery	3 (30.0)
	Neurosurgery	1 (10.0)
	Vascular Surgery	2 (20.0)
	Obstetrics and Gynecology (Obsgyn)	0 (0.0)
	Orthopedic Surgery	4 (40.0)
ART (min)	Mean ± SD	21 ± 1.94

Out of 116 patients, there were 18 patients who received invasive arterial line [2 (11%)] or central venous catheter (CVC) [16 (89%)]. No patients were fitted with both, nor other invasive procedures such as nasogastric tube, fiber optic intubation. All these patients were compliant with the Benchmark.

There were 10 (8.6%) surgeries with ART that did not meet the benchmark (Table 4). Patient demographics were predominantly male and the age group was 20-39 yr. The most common emergency surgeries that did not meet ART benchmarks were orthopedic surgical procedures with epidural anesthesia and delays due to waiting for the surgical operator. In terms of ASA status, there were no ASA ≥3 statuses with the majority of ASA 2 statuses (70%) of all findings. Epidural anesthesia type accounted for 90% (n = 9) of prolonged ART findings and 10% (n = 1) in general anesthesia type. There were no findings in regional anesthesia type SAB. From the above characteristics data, we further analyzed the appropriateness of ART based on ASA status and anesthesia type (Table 5).

From ASA status 1-2, the percentage of ART conformity to benchmarks was similar, 88% for ASA status 1 and 89.71% for ASA status 2. Comparison by anesthesia type showed that the conformity of general anesthesia type was 98.46% and SAB regional anesthesia type was 100%. Meanwhile, only 30.76% of epidural regional anesthesia types achieved ART according to benchmarks. The mean ART of epidural anesthesia type in the extended ART group was 21.55 min (SD ± 0.88).

To determine the factors of ART that did not meet the benchmark, the questionnaire sheet included the causes of ART. Of the 10 findings of prolonged ART, 60% were due to difficulty in anesthesia technique, 30% due to waiting for the surgical colleague, and 10% due to monitor malfunction (Table 6).

Table 6. Factors causing prolonged ART

Category	N (%)
Waiting for the surgeon	3 (30)
Waiting for local anesthesia agent onset	6 (60)
Monitor malfunction	1 (10)

4. DISCUSSION

The gender of the study subjects was equal between male and female. The mean age was 36.76 y with most

Table 5: ART and Compliance differed by ASA status and type of anesthesia

Factor		Patient Number	Compliant with the benchmark	Not compliant with the benchmark
ASA Status	1	25	22 (88.0)	3 (12.0)
	2	68	61 (89.71)	7 (10.29)
	3	23	23 (100.0)	0 (0.0)
Anesthesia Type	General Anesthesia	64 (98.46)	64(98.46)	64 (98.46)
	Regional SAB	38 (100.0)	38 (100.0)	38 (100.0)
	Regional Epidural	4 (30.76)	4 (30.76)	4 (30.76)

Data presented as n (%)

subjects in the 20-39 years age group (44%). There were no subjects with ASA 4. The distribution of the most Obgyn surgical procedures reached 29.3% (n = 34), similar to the emergency surgery study in Surabaya.[4] Gastrointestinal surgery 15.5% (n = 18) and Urological surgery 12.9% (n = 15) were the second and third most common procedures, and the least was plastic surgery at 6% (n = 7). In contrast to the findings of other studies abroad that often found the highest distribution of Orthopedic emergency surgeries[2,4], in this study, orthopedic surgery procedures were found to be quite small at only 7.8% (n = 9).

4.1. Anesthesia Ready Time

The ART compliance rate for emergency surgery in this study was 91.4%, with 106 anesthesia services in accordance with the ART benchmark. There were 8.6% (n = 10) of 116 anesthesia services that did not meet the ART benchmark. The overall mean ART was 14.22 min (SD ± 1.83). There were no findings of ART >30 min or 0%. The finding of no ART >30 min is satisfactory, when compared to the results of a study in a teaching hospital in Pakistan with an average of 70% and another study in a domestic teaching hospital which was only around 30%.[3,4]

From the results of the average ART based on the type of anesthesia, only in the epidural regional anesthesia type, the average value obtained extends from the benchmark based on previous study. The average value of ART in the SAB regional anesthesia type is 13.65 min, in accordance with the SAB regional benchmark of 15 min. While in the epidural anesthesia type, the average ART value is 20.77 min, extending from the benchmark time of 20 min.[2]

ART in the general anesthesia type group was found to average 13.77 min, but in more detail the type of general anesthesia was assessed separately based on ASA status. In the general anesthesia type group, ASA status 1 had a mean ART of 13.36 min, ASA status 2 had a mean ART of 13.81 min, and ASA status 3 had a mean ART of 14.25 min. The average value of ART in the ASA 1-3 status group obtained is in accordance with the ART benchmark, which is 15 min for ASA 1-2 and 30 min for ASA 3-4.[2] In this study, there were no samples of general anesthesia types with ASA 4 status.

Similar to the type of general anesthesia, further analysis was carried out on both types of regional anesthesia SAB and epidural based on ASA status. In the SAB regional anesthesia type, there were no samples with ASA status 1 and ASA status 4. The mean ART value in the ASA status 2 group was 13.65 min and the ASA 3 group was 13.71 min. Both the ASA 2 and ASA 3 status groups' mean ART values were in accordance with the SAB procedure benchmark time of 15 min. Similarly, when assessed with the ASA status 2 and 3 benchmarks, the mean ART values were still in accordance with the benchmarks of 15 min and 30 min, respectively.[2] In the epidural type of regional anesthesia, the mean ART value of the ASA status 1 group was 21.0 min and the ASA status 2 group was 20.70 min. The ART of both ASA statuses was prolonged, both from the epidural procedure benchmark of 20 min and from the ASA benchmark of 15 min. There were no samples in ASA status groups 3 or 4 in the epidural regional anesthesia type.

In general, the findings of this ART indicate that anesthesia services in emergency surgery cases at the tertiary hospital in Indonesia are quite good compared to previous studies in Pakistan, which served as the basis for the researcher's benchmarks and references. This is based on the ART results in all ASA statuses performed by general anesthesia and SAB types, which are in accordance with the benchmarks. However, the findings on anesthesia services performed with epidural type of action were still not optimal due to ART findings that extended from the benchmark time. The difficulty of the epidural procedure is one of the factors that often arises in various places.[2,4] This is one of the components of the factors that affect ART, namely the resource factor (Human) and anesthesia technique (Method).[5] Furthermore, in more detail, it will be explained in the subchapter of ART factors lengthening.

4.2. Invasive Procedure Time Duration

The calculation of anesthesia service readiness time starts from the time the monitor is installed until the patient is declared ready for surgery, without including positioning the patient or other further preparations.[2,6] The analysis of the readiness component of this study is divided into three, namely: monitor insertion time, induction duration, and invasive procedure time duration. It is important to note that in the anesthesia service of the tertiary hospital, after the induction process is complete, the surgical operator can start the surgical procedure without waiting for the anesthesia invasive procedure to be completed. Anesthesia invasive procedures can be performed at the same time as the surgical operator performs the procedure. This is an important factor that allows for shorter ART and more effective overall surgical management duration. Therefore, it can be said that the ART in this study only has two components, namely monitor insertion and induction duration. Monitor insertion took an average of 3.39 min (SD ± 0.92) and induction duration was 10.83 min (SD ± 1.69). Until now, there is no standardized time duration for these two things.

Out of 116 patients, 18 of them required invasive anesthesia. Two types of invasive anesthesia were recorded, namely, arterial line and CVC insertion. There

was no invasive nasogastric tube (NGT) or fiber optic intubation. The average invasive procedure process was 13.17 min with SD ± 3.11, in accordance with the benchmark used in the study which is the duration of invasive procedure time of 15 min.[2] The analysis continued with the duration of invasive procedures and compliance with benchmarks for each action. For the arterial line procedure, the mean procedure duration was 5.0 min (SD ± 0.0) with 100% compliance with the benchmark. This average is better than similar studies in other teaching hospitals in Indonesia with findings that the average arterial line insertion ranged from 9-21 min.[4,7] CVC actions require an average duration of 14.18 ± 0.98, with a level of conformity with the benchmarks set reaching 100%. The average duration of CVC procedures in this study was better than similar studies that found the average duration of CVC insertion ranged from 18-21 min.[4,7] Thus, the level of conformity of invasive procedures both in general and in each type of invasive procedure was very satisfactory, namely 100%.

There were differences related to invasive anesthesia measures in this study with previous studies. Intravenous (IV) line insertion was not included as one of the anesthesia invasive procedures in this study. This consideration was based on the fact that all patients planning surgery in the central operating theater of Hasan Sadikin Hospital Bandung had an IV line installed before entering the operating room. Thus, this allows the duration of induction, invasive procedures, and overall, ART to be shorter and more effective.

4.3. Prolonged ART Factor

Of all cases of prolonged ART (n = 10), the mean ART was 21 ± 1.94 min. Orthopedic surgery was at the top,with a percentage of 40.0% (n = 4) followed by plastic surgery, vascular surgery and neurosurgery. There was no delays more than 5 min. This result compares favorably with the findings of a previous study that found delays >5 min ranging from 26.5%.[3]

An interesting finding was that 70% (n = 7) of the prolonged ART findings were in patients with ASA status 2 and the remaining 30% (n = 3) in patients with ASA status 1. No patients with ASA status 3 had prolonged ART; whereas in theory an increase in ASA status is directly proportional to anesthesia difficulties. This may be due to other non-patient factors causing ART delay.

In terms of anesthesia type, there were no SAB regional anesthetics with prolonged ART. Furthermore, 90% (n = 9) of ART mismatches were found in epidural anesthesia type and only 10% (n = 1) in general anesthesia type. The finding that the majority of ART discrepancies were in the epidural anesthesia type and the general epidural ART mean score that did not meet the benchmarks set in this study, suggests difficulties with the epidural procedure. The rate of ART non-compliance in epidural procedures reached 69.24%. It may be due to several factors, one of which is the difficulty of the epidural technique performed. A study in Semarang showed the same thing, where the failure rate of epidural procedures reached 20%.[8,9] Moreover, the duration of onset of epidural action is quite prolonged. The average ART of epidural anesthesia in the extended ART group was 21.55 ± 0.88 min. This finding is in accordance with the research of Zand et al. who mentioned the start time of bupivacaine in patients who performed epidural action was 17.12 ± 2.18 min for sensory block at L1 level and 24.9 ± 2. 54 min for sensory block at T10.[9] Although many epidural anesthesia techniques offer many advantages, the length of time for the anesthetic drug to work and a fairly high rate of procedure failure, is one of the main reasons epidural anesthesia techniques are often not chosen by anesthesia specialists.[8,10] To speed up the onset of action, epidural procedures with bupivacaine are often added with adjuvants, such as ketamine,[11,12] magnesium sulfate,[13] sodium bicarbonate,[8] and others. Other epidural analgesia drugs such as ropivacaine have a faster overall onset time of ± 14 min.[14] The starting time of ropivacaine motor block is within 5 min from various studies, when using the brachial plexus block.[14–16]

Induction duration is one of the influential components in ART. In a German study, prolonged induction duration was the most common factor contributing to prolonged ART.[3] Many anesthesia factors can prolong the induction duration, such as the learning process, waiting for the anesthesia team to be fully equipped, difficulty in intravenous access, anesthetic drug preparation and others. Epidural anesthesia technique accounts for a total of 60% of the overall causes of delay that most dominantly slowed ART in emergency surgery cases. This finding is in contrast to the study by Zafar et al. who found that learning activities were the most common factor delaying ART duration.[2]

Specifically, from the age group, only 1 (10%) sample in the age range of 0-9 y was found with neurosurgical procedures under general anesthesia. This was due to a malfunction of the monitor during the application of the monitor. This is included in the Machine factor. Routine daily checks of monitors and anesthesia machines are important procedures and have been mentioned in many studies, including a checklist from the Association of Anesthetists of Great Britain and Ireland (AAGBI).[17] Anesthesia monitors consist of various devices, which sometimes have different challenges for each type of device. Although the results of the study showed the shortest monitor setup time, the installation of all monitor components such as electrocardiogram electrodes, blood pressure cuffs, and peripheral oxygen

saturation must be ensured to be correct and functional.[18,19]

Although not found in this study, in the process of invasive procedures such as central venous access insertion, one of the most common complicating factors that prolong the duration of the procedure is pediatric patients.[2,3] In addition, the learning process of invasive procedures with fiberoptic equipment is also often an influencing factor.[2] In this study, none of the samples were intubated using fiberoptic laryngoscope.

The last factor found in this study was delay due to waiting for surgical team personnel, which accounted for 30% (n = 3). This is significantly higher than the 1.6% found in Pakistan.[2] However, two studies in Indonesia found similar results with 25%,[6] and up to 50% in another study.[7] This is one of the Human Factors. Good cooperation between the person in charge of the operating room, anesthesia team and surgical team is needed to ensure the timely presence of all teams involved. Of all the factors found in this study, all of the things that affect ART prolonging are correctable causes.

5. LIMITATIONS

In this study, there were no samples with ASA 4 status, and the number of samples of patients with ASA 3 status was relatively small. This limits a more complete and comprehensive analysis, especially the possibility that other factors affecting anesthesia services in emergency surgery in patients with higher ASA status will be different from ASA status 1 to 3. A multi-center long-duration study might offer more dependable conclusions.

6. CONCLUSION

The average Anesthesia Ready Time in patients who performed emergency surgical anesthesia services at a tertiary hospital in Indonesia with the types of general anesthesia and regional subarachnoid block is in accordance with the benchmark. Meanwhile, for the type of epidural regional anesthesia 20.77 min, it was close to the benchmark of 20 min. Factors found to affect ART in emergency surgery anesthesia services at the tertiary hospital showed that waiting for the onset of local anesthesia time to work in epidural analgesia, waiting for the surgeon or operator, and equipment malfunction were factors that affected the anesthesia ready time.

7. Data availability

The numerical data generated during this research is available with the authors.

8. Acknowledgement

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9. Conflict of interest

The study utilized the hospital resources only, and no external or industry funding was involved.

10. Authors' contribution

All authors took part in the conduct of the study, literature search, data analysis, manuscript writing and review. All authors have read the paper and approved for publication.

11. REFERENCES

1. Ruskin KJ, Rosenbaum SH. Anesthesia Emergencies. Oxford University Press; 2015.
2. Zafar SU, Khan FA, Khan M. Standardization of anaesthesia ready time and reasons of delay in induction of anaesthesia. J Pak Med Assoc. 2006;56(3):112-115. [PubMed]
3. Joos C, Bertheau S, Hauptvogel T, Auhuber T, Taube C, Bauer M, et al. Case delay in the OR morning start in hospitals of different size and academic status. Anaesthesist. 2021;70(1):23-29. [PubMed] DOI: 10.1007/s00101-020-00842-2
4. Prabowo YA, Basoeki AP, Sylvaranto T, Edwar PM. Analisis anesthesia ready time dalam pelayanan anestesi untuk pembedahan darurat di kamar operasi IGD RSUD Dr. Soetomo Surabaya tahun 2018. J Anestesiol Indones. 2018;10(3):134. DOI: 10.14710/jai.v10i3.20278
5. Gupta B, Agrawal P, D'souza N, Soni KD. Start time delays in operating room. Saudi J Anaesth. 2011;5(3):286-288. [PubMed] DOI: 10.4103/1658-354X.84103
6. Boggs SD, Tsai MH, Urman RD. The Association of Anesthesia Clinical Directors (AACD) glossary of times used for scheduling and monitoring of diagnostic and therapeutic procedures. J Med Syst. 2018;42(9):171. [PubMed] DOI: 10.1007/s10916-018-1022-6
7. Wardhana R. Waktu yang dibutuhkan untuk mencapai anesthesia ready time dalam pelayanan anestesi untuk operasi elektif di GBPT RSUD DR Soetomo Surabaya. Universitas Airlangga; 2015. [FreeFullText]
8. Marwoto M, Raharjo SP. Onset response of bupivacaine 0.5% which has been added with sodium bicarbonate on epidural block. Med J Indones. 2005;14(1):7-10. DOI: 10.13181/mji.v14i1.167

9. Zand F, Azemati S. Comparative study of onset and duration of action of 0.5% bupivacaine and a mixture of 0.5% bupivacaine and 2% lidocaine for epidural anesthesia. Anaesthesia. 2004;42:10-16. [FreeFullText]

10. Macfarlane AJR, Brull R, Chan VWS. Spinal, epidural and caudal anesthesia. In: Basics of Anesthesia. Chap 17, 273-302; 2015. p.1684-1720.

11. Patel I, Ghandhi R, Shah A, et al. Comparative study of bupivacaine vs bupivacaine and ketamine (intrathecally) during intraoperative and postoperative analgesia in non-PIH caesarean section. Nat J Med Res. 2011;1(2):71-75. [FreeFullText]

12. Swain A, Nag DS, Sahu S, Samaddar DP. Adjuvants to local anesthetics: current understanding and future trends. World J Clin Cases. 2017;5(8):307-323. [PubMed] DOI: 10.12998/wjcc.v5.i8.307

13. Kogler J. Effects of epidural magnesium sulfate on intraoperative sufentanil and postoperative analgesic requirements in thoracic surgery patients. Signa Vitae. 2016;11(1):56-73. **DOI:** 10.22514/SV111.052016.4

14. Kaur A. Comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries under axillary brachial plexus block: a prospective randomized study. J Clin Diagn Res. 2015;9(1):UC01-06. [PubMed] DOI: 10.7860/JCDR/2015/10556.5446

15. Mageswaran R, Choy YC. Comparison of 0.5% ropivacaine and 0.5% levobupivacaine for infraclavicular brachial plexus block. Med J Malaysia. 2010;65(4):300-303. [PubMed]

16. McGlade DP, Kalpokas MV, Mooney PH, Chamley D, Mark AH, Torda TA. A comparison of 0.5% ropivacaine and 0.5% bupivacaine for axillary brachial plexus anesthesia. Anaesth Intensive Care. 1998;26(5):515-520. [PubMed] DOI: 10.1177/0310057X9802600507

17. Association of Anaesthetists of Great Britain and Ireland (AAGBI), Hartle A, Anderson E, Bythell V, Gemmell L, Jones H, et al. Checking anaesthetic equipment 2012. Anaesthesia. 2012;67(6):660-668. [PubMed] DOI: 10.1111/j.1365-2044.2012.07163.x

18. Kain ZN, Mayes LC, Caldwell-Andrews AA, Karas DE, McClain BC. Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery. Pediatrics. 2006;118(2):651-658. [PubMed] DOI: 10.1542/peds.2005-2920

19. Dave N. Premedication and induction of anaesthesia in paediatric patients. Indian J Anaesth. 2019;63(9):713-717. [PubMed] DOI: 10.4103/ija.IJA_491_19

