

ORIGINAL ARTICLE

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Evaluation of monitorization in anesthesia applications outside the operating room, compatibility of standard infrastructure and equipment : A survey study** Duygu Demiroz Aslan¹,  Ayse Gul Ferlengez²,  Neslihan Altunkaya Yagci¹**¹Inonu University, Faculty of Medicine, Department of Anesthesiology and Reanimation, Malatya, Turkey²Istanbul Training and Research Hospital , Department of Anesthesiology and Reanimation, Istanbul, Turkey

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**Abstract**

We aimed to evaluate the suitability of monitoring, standard infrastructure and equipment in anesthesia applications of anesthesiology reanimation specialists and resident physicians working in Istanbul and increase the awareness of them. 106 anesthesiology reanimation specialists and resident physicians working in Istanbul and Malatya included in the study. The results of the survey consisted of 31 questions were obtained by collecting data via electronic data form on the web. Statistical analysis was used. In our study, the presence of oxygen supply, aspirator and probes in the areas of anesthesia outside the operating room, the presence of light source is sufficient, the most commonly used respiratory parameters of the monitoring methods and cardiovascular monitoring was followed. In these areas it was seen that 94% of the emergency trolleys were found and in the emergency boxes it was seen that the drugs used for cardiac arrhythmia and arrest treatment were usually found. There was a 40% defibrillator and a 60% support team for emergency situations and 56% of the system that could communicate for assistance. 74% of the recovery unit and 37% of the waste gas system were found outside the operating room. We believe that monitoring, compliance of standard infrastructure and equipment are effective to prevent complications in anesthesia outside the operating room applications.

Keywords: Anesthesia outside the operating room, survey, safe anesthesia**Introduction**

Today, invasive and non-invasive intervention for diagnosis and treatment purposes have been used frequently in the non-operating room setting. Non-operating room anesthesia (NORA) applications have been widely used. Day anesthesia was performed for the first time by Wallace Read in 1970, and it has shown a great development for 20 years. NORA applications have many advantages in terms of patients, healthcare staff, hospital and costs. On the other hand, these applications include serious problems and complications [1]. All mandatory standards for anesthesia in operating rooms should also apply to NORA applications [2, 3]. In our country, there is a guideline for non-operating room anesthesia application among the guidelines among the Anesthesia Practice Guidelines published by the Turkish Anesthesiology and Reanimation Society (TARS) in 2005 [4].

Materials and Methods

A survey involving 31 questions was prepared based on the guideline for NORA applications among the Anesthesia Practice Guidelines published by TARS. All 31 questions have answers consisting of two options, while the response time was calculated as 4 minutes (Table 1). The survey data were distributed to the Anaesthesiology and Reanimation specialists and resident physicians who are currently working throughout Istanbul and Malatya, through the electronic data form via the web. The survey forms were introduced to the participants and the objective of the study was described with a short text. First, they were asked if they approve to participate and gave written consent. Ethical approval was not needed since there is a survey study. A total of 110 physicians were included in the study. Four physicians were excluded from the study since they did not fill the survey forms completely. Answers of the remaining 106 physicians were evaluated.

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Data obtained in this study were evaluated by the researchers using descriptive statistics (percentage, mean, standard deviation).

Table 1. Survey questions

No	Question	Options
1	Is there any oxygen source?	A) Yes B) No
2	Is there an aspirator?	A) Yes B) No
3	Are there different-size ports and aspiration probes?	A) Yes B) No
4	Is the light source adequate? (battery powered backup light source)	A) Yes B) No
5	Are there enough sockets?	A) Yes B) No
6	Are there monitors (working)?	A) Yes B) No
7	Are there respiratory monitors?	A) Yes B) No
8	Are there cardiovascular monitors?	A) Yes B) No
9	Are there body temperature measurement monitors?	A) Yes B) No
10	Is there neuromonitor?	A) Yes B) No
11	Is there an emergency trolley?	A) Yes B) No
12	Are medications for cardiac arrhythmias and cardiac arrest available?	A) Yes B) No
13	Are there medications for treatment of anaphylaxis in the emergency trolley?	A) Yes B) No
14	Are there medications for treatment of bronchospasm?	A) Yes B) No
15	Are there medications for treatment of pulmonary edema?	A) Yes B) No
16	Are there medications for treatment of hyper- and hypoglycemia?	A) Yes B) No
17	Are there medications for treatment of hyper- and hypotension?	A) Yes B) No
18	Are there medications for treatment of adrenal dysfunction?	A) Yes B) No
19	Are there medications for treatment of respiratory depression?	A) Yes B) No
20	Are there medications for treatment of uterine atony and coagulopathy?	A) Yes B) No
21	Are there medications for treatment of increased intracranial pressure?	A) Yes B) No
22	Are there injectors, intravenous cannulas, intravenous fluids and sets?	A) Yes B) No
23	Are there scissors, plaster, Magill forceps, tourniquet etc.?	A) Yes B) No
24	Are there oral-nasal airway tools, different-size masks, and tongue spoons for adults and pediatric in the emergency trolley?	A) Yes B) No
25	Is there alternative emergency airway equipment?	A) Yes B) No

26	Are there defibrillators, compatible adult and pediatric pads?	A) Yes B) No
27	Is support team is available for emergency situations?	A) Yes B) No
28	Is there a special phone line, pager or intercom system that it can communicate with for an emergency call for anesthesiology?	A) Yes B) No
29	Is there an appropriate place to perform general anesthesia in the case of emergency?	A) Yes B) No
30	Is there waste gas system, if inhalation anesthetics are used?	A) Yes B) No
31	Is there an area for patients' recovery following anesthesia and procedure?	A) Yes B) No

Results

A total of 102 (96%) 'Yes' answers were received to the question that "is there an oxygen source?" while four participants responded as "No". When availability of aspirator and aspiration probes was questioned, the same answers were given to the questions 2 and 3, including 96 (91%) "Yes" and 10 (9%) "No". Ninety-five (90) "Yes" and 11 (10%) "No" answers were given to the question that

"is the light source sufficient?". A total of 104 (98%) "Yes" and 2 (2%) "No" answers were received to the question that "is there enough plugs?"

Monitoring methods used during the NORA applications were questioned. The most common method was monitoring of respiratory parameters by 100% and the least common method was monitoring of bispectral index by 5% (Table 2).

Table 2. Monitoring availability rates in NORA applications of anaesthesiology and reanimation physicians

	Yes n (%)	No n (%)
Respiratory monitoring	106 (100)	0 (0)
Cardiovascular monitoring	99 (93)	7 (7)
Body temperature monitoring	5 (5)	101 (95)
Bispectral index monitoring	5 (5)	101 (95)

When availability of an emergency trolley was questioned, 100 (94%) anesthesiologists answered as "Yes" and 6 (6%) as "No". Medications in the emergency trolley were investigated with the questions 12-29 and the most commonly used drugs were found

as those used in treatment of cardiac arrhythmias and cardiac arrest by 98%. The least commonly used drugs were those used for treatment of uterine atony and coagulopathy (Table 3).

Table 3. Distribution of medications in the emergency trolleys in NORA applications of anaesthesiology and reanimation physicians

	Yes n (%)	No n (%)
Medications used for treatment of cardiac arrhythmias and cardiac arrest	104 (98)	2 (2)
Medications used for treatment of anaphylaxis	101 (95)	5 (5)
Medications used for treatment of bronchospasm	91 (86)	15 (14)
Medications used for treatment of pulmonary edema	68 (64)	38 (36)
Medications used for treatment of hyper- and hypoglycemia	43 (41)	63 (59)
Medications used for treatment of hyper- and hypotension	64 (60)	42 (40)
Medications used for treatment of adrenal dysfunction	21 (20)	85 (80)
Medications used for treatment of respiratory depression	82 (77)	24 (23)
Medications used for treatment of uterine atony and coagulopathy	17 (16)	89 (84)
Medications used for treatment of increased intracranial pressure	21 (20)	85 (80)

Other equipment found in the NORA application areas were found as alternative emergency airway tools and defibrillators by 40% (Table 4).

According to our study, an appropriate place for performing anesthesia in the case of emergency was found by 44%, availability of a support team by 60% and availability of a phone, pager or

intercom system that can be communicated with when necessary by 56% (Table 5).

In the NORA application areas, a waste system was found by 37% and a recovery area by 74% in the sites where inhalation anesthetics were used (Table 5).

Table 4. Availability rates of other equipment in NORA applications of anaesthesiology and reanimation physicians

	Yes n (%)	No n (%)
Injectors, IV cannulas, intravenous fluids and sets	77 (72)	29 (28)
Scissors, plaster, Magill forceps, tourniquet etc.	46 (44)	60 (56)
Oral-nasal airway tools for adults and pediatric different-size masks, tongue spoons	84 (79)	22 (21)
Alternative emergency airway equipment	42 (40)	64 (60)
Defibrillators (compatible adult and pediatric pads)	42 (40)	64 (60)

Table 5. Availability rates of support team, pagers, emergency general anesthesia conditions, waste gas system and recovery rooms in NORA applications of anaesthesiology and reanimation physicians

	Yes n (%)	No n (%)
Availability of support team for emergencies	64 (60)	42 (40)
Availability of a special phone line, pager or intercom system that it can communicate with for an emergency call for anaesthesiology?	60 (56)	46 (44)
Is appropriate area to perform anesthesia in the case of emergency	46 (44)	60 (56)
Waste gas system	39 (37)	67 (76)
Recovery room	68 (74)	38 (36)

Discussion

The American Society of Anesthesiologists (ASA) and TARS guidelines underline the necessity of basic conditions for safe anesthesia application in the NORA practice areas [4]. The responsibility of providing safe anesthesia belongs to the anesthesiologist. In a study by Silber et al. [5], complication rates were higher in the areas where NORA management was not provided by anesthesiologists. Aydın [6] emphasized that NORA applications should be performed by an anesthesiologist in order to minimize the risk brought by these applications. Before the anesthesia application, the anesthesiologist should investigate and examine the place where anesthesia will be administered. In addition, anesthesiologists are recommended to prepare a checklist before the procedure [1, 4, 7]. The anesthesiologist should determine an oxygen tube, aspirator, waste gas system, resuscitation equipment and medications, power and light source, and communication system [1]. In our study, we evaluated the approaches of the anaesthesiology and reanimation physician to NORA applications in line with this information and observed that many physicians working in Istanbul and Malatya provinces pay attention to these during NORA applications.

In a study by Robbertze et al. [7], most of the complications associated with NORA were reported to occur with anesthesia care monitoring and in patients of end ages. However, the authors concluded that unlike operating room anesthesia, mortality increased in the NORA application sites, practices were under standards and many complications can be prevented by paying attention. Similarly, Applegate et al. reported that monitoring applications decreased serious complications in patients receiving

sedation [11]. Monitoring applications vary depending on patients' characteristics, anesthesia methods used and the intervention. Froehlich et al. [8] demonstrated that pulse oximeter was used by 77%, blood tension measurement by 34% and electrocardiography by 24% in colonoscopy cases. In a survey study by Yildiz et al. [9] it was reported that there is not a sufficient organization in the NORA practice in Turkey, these applications are performed by physicians who are not anaesthesiology and reanimation specialists and standards specified by ASA are not followed during these procedures. In our study, the most commonly used monitoring method was respiratory parameters monitoring by 100% followed by cardiovascular monitoring (93%).

Respiratory complications and hypoxemia may be seen in sedated patients and oxygen administration during the procedure can reduce the rate of complications [4]. Karamnow et al. reported the most commonly seen complication in the NORA applications as apnea [12]. In our study, we found the rate of oxygen usage during the NORA applications as 96%.

One of the reasons for the high rates of morbidity and mortality in NORA application is the lack of anesthesia and resuscitation equipment or not knowing how to use the devices due to their old age [1, 4]. In our study, we found that emergency trolleys were available by 94% and defibrillators by 40%. WE think that the rate of defibrillator availability was not sufficient. In addition, according to our results availability of aspirators and aspiration probes was sufficient by 91%, light sources by 90% and plugs by 98%.

The anesthetists being alone in emergency intervention and being

away from the center as a result of the lack of adequately trained personnel in NORA application areas increases the complication rate [1, 4]. In our study, a support team for emergency was available by 60% and a communication system for emergency calls by 56%.

According to the standards of the areas where NORA is applied, there should be an adequate and safe system for the removal of waste gases in the areas where inhalation anesthetics were used [13]. The question that “whether there is a waste gas system in the area where you use inhalational anesthetics?” was answered as “Yes” by 37%. We think that this rate was not sufficient.

After a NORA procedure is completed, the patient should be monitored closely, and continuous peripheral oxygen saturation should be continuously monitored until the space-time orientation is completed and vital parameters are stabilized [14, 15]. Patients are at risk of complications following anesthesia application and they should be monitored in the recovery room until the risk of cardiopulmonary depression is eliminated and the level of consciousness returns to normal [4]. In our study, a recovery is available in 74% of the areas where NORA was performed.

Conclusion

Compliance with standards and safety precautions specified by the guidelines for NORA applications is important in order to prevent complications. We think that paying attention to the compliance of standard monitoring infrastructure and equipment, and providing appropriate conditions before the procedure will be effective in preventing complications.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

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Ethical approval

Ethics approval was obtained before the study (23.03.2021 2021/1715).

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