

Developing Protocols for Administering Anesthesia

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Abstract

The industrial sector especially the aviation industry has shown the world that by using check lists and protocols, disasters could be prevented. It is now a common practice in many fields to establish protocols to standardize the practices. Such standardization makes the processes similar despite various users practicing the procedure. Although in anesthesia, there are several guidelines suggested by bodies such as the American society of anesthesiologists and Indian society of anaesthetists, strict protocols are not available even for the commonly undertaken procedures. Anesthesia is akin in many respects to flying an aircraft. The induction of anesthesia compared to take off of an aircraft, maintenance to cruising and extubation to landing. It was therefore thought that anesthesia similar to aircraft flying could be made safer by using protocols and checklists. However it may take a while for the practice of anesthesia to get to the “6 Sigma” safety that the airline industry currently enjoys. It is our effort to standardize the commonly performed surgeries at our institution. “The protocols in Anesthesia” emerged as a result of the back breaking work of the consultants in the department of anesthesia. The intention of this effort was to standardize the practice of anesthesia in our institution and to showcase the benefits of such standardization. It is hoped that other institution interested in standardizing their practice could formulate their own protocols. It is also desirable that a “copy and paste” of other protocols is unlikely to benefit the end users. The authors wish to bring forth the point that customized protocols should emerge with the efforts of the users themselves. It becomes more pertinent to suit one’s protocol to the prevailing infrastructure, availability of therapeutic agents and economic conditions. The authors sincerely hope this endeavour might stimulate others to put their systems in place, if not pre-existing

Key words: Anesthesia, protocols, teaching, training

INTRODUCTION

Anesthesia is considered one of the few high-risk areas in medicine which has been rendered safe – claimed a report of Institute of Medicine’s publication – To err is human: Building a safer health-care system. The statistics shown by the Institute of Medicine that the mortality in anesthesia decreased from 2/10,000 in the year 1980 to 1/200,000–300,000 in the early 2000s was indeed impressive, but the source of this evidence was questioned by Joint Commission.^[1,2] The safety in anesthesia was made possible by instituting risk reduction strategies. One such well-recognized strategy is using checklist. Hart *et al.* from Australia showed the relevance of the checklist as used by the pilots.^[3] They concluded that important checks may be forgotten when preparing to administer general anesthetic, and the use of a checklist could improve patient safety. The process of anesthesia itself generally involves the following stages: Preoperative assessment of the patient, premedication, administration of anesthesia, recovery from it, and postoperative management.

These processes are usually fairly well-stabilized in most centers. Individual hospitals might have little variations between each other, but most techniques will be as per the guidance from textbooks and/or journals. Many at times, variation in techniques between two anesthesiologists within the same hospital persists despite efforts by the head of the department at standardization of the technique in the department. In large centers where many anesthesiologists with varying degrees of experience and expertise work rotate in various subspecialties, such variations may increase in proportion leading on to confusion among the junior staff, anesthesia technicians, and nurses. Errors might be reduced by a common pre-existing standardized approach. Changes (if any) in the standard approach should be instituted after careful

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deliberation of all concerned. The safety in aircraft industry achieved by strict adherence to the checklist is an example of this. We come to ask ourselves the inevitable question, is there a protocolization required to administer anesthesia? In this review article, we will elaborate on this question and share with the readers about how the protocol was made and established at our institute [Figure 1]. It is relevant here to note that the Indian Society of Anesthesiologists has already made significant guidelines about the education of doctors in the field of anesthesia and patient safety. They are:

- Course specifications (Diploma in anesthesia, Master degree, and postdoctoral)
- Appraisal assessment and supervision of training
- Attitudes, communication, and behaviour development
- Medical ethics and law
- Examination system
- Minimum monitoring standards and infrastructural requirement for conducting anesthesia and surgical operations.

Despite this excellent effort from the institution, it may not be out of place for each departments of anesthesia to standardize the anesthesia practiced at their institution. This in the author's opinion may trigger a "ripple effect" and stimulate others to establish their own protocol. Once the procedure of making protocols becomes more acceptable, each institution could approach the Indian Society of Anaesthesiologists and get their protocols approved by the supreme body. This will put a stamp of the institute's authority on the topic and help the practitioners when faced with medicolegal issues.

PREPARING THE PROTOCOL

The protocol was made with the following intentions on mind:

- The institution where we currently practice was started in the year 2006; we had nearly 18 anesthesiologists joining us from other institutions from within the city and out of it. It was soon realized that each one had preference to their "own" techniques. This resulted in varying outcomes in the quality indicators (such as

postoperative nausea vomiting and time to discharge from postanesthesia care unit); this depended on the anesthesiologist who carried out the anesthesia procedure. A need for a common standardized approach to patients soon became a necessity

- The trainees in the department were not sure which technique they had to follow. To give them direction, it was thought that anesthesia protocol was a necessity
- The success of a team is because every individual does what is expected of him/her. At times, an anesthesiologist new to a particular surgery may not be complimentary to the team. These newcomers may be asked to whet the protocol prior to starting the procedure
- There are several unpublished practical points which will not be known to most others except the one practicing it. Such points may be incorporated in the protocol so that all the colleagues in the department learn these. It is not mandatory for a practice to be formalized by publication in a scientific journal before it becomes evidence
- When new appointments are made, the incoming anesthesiologists may not be aware of subtle points which may be surgery-specific. By not appropriately carrying them out, one might compromise the outcome of the surgery
- It is not uncommon to find the Indian patients behaving differently to a few pharmaceutical agents. The textbooks being mostly Western may not have any details on the Indian perspective to the pharmaceutical agents and their possible adverse effects
- When a particular anesthesiologist practicing in a subspecialty for a considerable period of time has to conduct a case from yet another subspecialty, he/she may not be aware of the recent developments within his/her own departments. A handy protocol will come in useful.

BENEFITS OF HAVING AN ANESTHETIC PROTOCOL

- Same degree of standardization in terms of techniques, pharmaceutical agents, and monitoring may be expected from all the members in the unit
- Newcomers may be asked to go through the protocol to get a fair bit of knowledge about the way cases are conducted
- Despite these measures if an incident occurs, the person who caused the incident could be shown the benchmark
- Any new changes required or development in the field could be inserted in the protocol. By reviewing the series of protocols, one may quickly check the growth of various modifications in subspecialties
- If medicolegal issues arise, the protocol will be a useful document to show the relevant authorities the standardized practice recommended within the department. The question whether those were followed in the case in question is a moot one.

The protocol was prepared keeping in mind the subspecialties and commonly conducted surgeries in the department. They were described as follows:



Figure 1: The protocol book

- a. Cardiothoracic and vascular anesthesia
 - Off-pump coronary artery bypass surgery
 - Redo coronary artery bypass graft surgery
 - Paediatric cardiac surgery
 - Cardiopulmonary bypass
 - Awake coronary artery bypass graft surgery.
- b. Orthopaedic surgery
 - Total knee replacement
 - Total hip replacement
 - Shoulder arthroscopy
 - Knee arthroscopy
 - Upper limb fractures
 - Lower limb fractures
 - Paediatric orthopaedic surgeries
 - Hip fractures.
- c. Anesthesia for general and laparoscopic surgery
 - Laparoscopic surgeries
 - Laparotomy
 - Perineal surgeries
 - Lower segment cesarean section including labor analgesia
 - Urology, plastic surgery, and thoracic surgery.
- d. Neurosurgery
 - Spine surgeries
 - Cranial surgeries.

- requiring treatment of pathology of cervical spine^[7,8]
- Similarly, patients with kyphoscoliosis may require detailed pulmonary function test to assess the requirement of elective postoperative ventilation. They also need to be informed about the possibility of “wake-up test,” if the neurosurgeon conduct the case plans to use this test to assess the integrity of spinal cord function^[9-12]
- In cases where difficulty in intubation is anticipated and awake fiberoptic intubation is planned, the patient may be explained the procedure to alleviate the anxiety. A few neurosurgeons position the patient for cervical spine fixation prone, after awake intubation and carryout the induction of general anesthesia thereafter. A patient who is not aware may not cooperate for these maneuvers^[13,14]
- Although it is a matter of routine requirement that “Allen’s test” or modified “Allen’s test” be carried out before arterial cannulation, at times, in otherwise low-risk cases, where routinely invasive arterial pressure monitoring is not considered, one may not carry out the test. However, the list of cases requiring invasive arterial cannulation is mentioned in our protocol^[15,16]
- Similarly, while carrying out the procedure under “monitored anesthesia care,” it may be relevant to keep the patient informed about the entire proceedings to allay anxiety. This is a matter of utmost importance while conducting “awake heart surgery” under high-thoracic epidural anesthesia.

All the protocols were classified under the same headings. They are shown in the following in Table 1.

Preanesthetic examination

Most patients qualify to have similar checks during the preanesthetic check. However, a few aspects of preanesthetic examination vary from one subspecialty to another.^[4-6] The following are the examples:

- Assessment of hydration is necessary in patients undergoing laparotomy. While it may not be necessary in an elective nonabdominal surgery or other types of elective surgeries
- Although airway assessment is mandatory in all the cases, it should be carried out in particular detail in cases

These are only a few examples. The author is certain that every group involved in providing anesthetic care will have their “dos and don’ts.” Documenting and standardizing are extremely important to bring about uniformity in the unit.^[7,8,17,18]

Preoperative investigations and instructions

It is a common knowledge that preoperative investigations change from one surgical specialty to another. An anesthesiologist not used to a particular subspecialty might not order relevant investigations which may be more contemporary or order investigations which have no relevance to the case in question. In a subspecialty of anesthesia at times, one might require to investigate the patient extensively *in lieu* of the physical condition of the patient.

Preoperative drug therapy; whether to continue or stop

The type and number of preoperative medications the patients receive have been on the raise. The preoperative medications widely vary from one subspecialty to another. However, a few of the preoperative medications appear to be constant between the surgical groups, and the requirement of cessation may also vary from one group of surgical patient to another.

- Clopidogrel, an antiplatelet medication used commonly in patients with ischemic heart disease, is conventionally ceased at least a week prior to the contemplated date of surgery. However, wherever nerve blocks are practiced under the ultrasound imaging, the surgeons, especially the orthopaedic surgeons, wish to continue the antiplatelet medications to provide the benefits of these medications in their patients^[19]

Table 1: Constant sub headings for each specially

Preanesthetic examination
Preoperative investigations and instructions
Preoperative drug therapy; whether to continue or stop
Information to operation theater
Medications and equipment to be kept ready at the anesthetic workstation
Anesthetic techniques in order of preference
Monitoring
Positioning of the patient
Induction of anesthesia
Maintenance of anesthesia
Reversal of neuromuscular blocking agent
Extubation
Transfer out of patient
Postoperative pain relief plan

- Guidelines to stop preoperative medications such as alpha blockers, angiotensin-converting enzyme inhibitors, and ganglion blockers are not clear. It is a good idea to keep the most contemporary concept while dealing with these medications. These changing concepts could be changed when newer versions of the protocols are released.

Information to operation theater

In our endeavour to standardize the systems involved in administering safe anesthesia, the authors considered it necessary to improve the communication with the operation theater and the anesthesia technicians. Under the subheading 'information to operation theater', issues such as readying the bronchoscope, percutaneous pacing and defibrillator paddles are included. These are not routinely readied by the operation theater nurses and technicians. Fiberoptic bronchoscope used for awake intubations, small caliber flexiscope to check the position of the endobronchial tube, lighted wand, extra-large laryngoscope blade, and extra-long epidural needles are some of the examples. Although it is necessary to store all the equipment likely to be required in the operation theater area, it may not be handy unless specially informed a day prior to anesthesia procedure. It is also pertinent to inform the operation theater personnel about scheduling a particular case, first in the morning. Conventionally, pediatric, elderly, diabetic, and high-risk cases are considered early on the list. If this information is deposited with the relevant operation theater manager, time will not be lost on the day of the operation. In certain selected cases, advanced hemodynamic monitoring may be required and equipment such as continuous cardiac output and semi-invasive continuous cardiac output (FloTrac®) have to be kept in readiness.

Medications and equipment to be kept ready on the anesthetic workstation

It is not uncommon to find "protocols" among anesthesiologists about the medications to be kept ready on the anesthetic workstation. However, making a standardized exhaustive list may turn out to be beneficial. In addition to the usual intravenous sedative, induction, neuromuscular blocking and reversal agents, certain special drugs may be required for certain subspecialty practices. To name a few, inotropes and dilators in cardiac surgery and syntocinon and prostaglandins in obstetric analgesia. In addition to the routinely used equipment such as laryngoscope, Magill's forceps, certain special equipment such as pacemakers, defibrillator, warming blanket, and rapid fluid infuser might at times be required for major surgeries such as cardiac, neuro, and abdominal surgeries. Providing prior information early will not only ease the pressure on the paramedical staff, but hassle of not finding the required equipment at the time of anesthesia may be avoided. The author can recount many occasions, transcutaneous pacing paddles, which are obviously needed during repeat heart surgery have been made readily available because of the protocol and prior information. Similarly, during awake heart surgery, the gamut of equipment required is not only rare but many at

times, not readily available in the operation theaters. To name a few, harness, tracheal esophageal tube (Combitube™), and nasopharyngeal airway.

Anesthetic techniques in order of preference

Although patient may either receive general anesthesia or regional anesthesia, the evidence-based choice should be readily available to the faculty and the trainees to avoid confusion. The idea of introducing this chapter is to provide definite direction to the anesthesiologists managing the case. While mentioning the first and subsequent techniques of choice, the technique of anesthesia continues to lie with the anesthesiologist managing the case.

Monitoring

The hospitals' "standard operating protocol" recommends certain minimum level of monitoring, the protocol guides the user about the additional monitoring that might be required based on the severity of the systemic comorbidities. The minimum monitoring for all the anesthetized patients at our institutes is described as follows:

- Electrocardiogram (ECG)
- Oxygen saturation
- Noninvasive blood pressure
- End-tidal carbon dioxide, respiratory gas, inhaled anesthetic agent level, and airway pressure in all mechanically ventilated patients
- Monitoring blood sugar and arterial blood gases among other monitors of metabolic issues in deserving patients is recommended at regular intervals
- Body perfusion parameters such as cardiac index, urine output, and oxygen-related parameters in patients who require minute-to-minute monitoring
- Invasive arterial pressure derived from radial artery from the nondominant hand and central venous pressure obtained through a cannula in the right internal jugular vein are common recommendations in patients undergoing high-risk surgery. However, the institutional protocol in cardiac surgery is to insert a femoral arterial line. It is the institute protocol to insert a cannula into the right internal jugular vein if there are no contraindications for the same
- Neuromuscular monitoring in bariatric surgical patients is necessary to prevent the overdosing of neuromuscular blocking agents in them. This aids fast tracking of the patients.

Positioning of the patient

The new recruits in the department are sensitized to the importance of the patient positioning. The trainees are trained to position the patients under supervision. Difficult positions such as prone are always undertaken by both the surgeon and anesthesiologists.

- Positions other than supine are used in most subspecialties in surgery. Each position is associated with a few issues with anesthesia. The protocol attempts to highlight them.

For example, in patients undergoing surgeries in the lateral positions, insertion of arterial and peripheral venous must preferably be carried out on the nondependent arm

- Urologic patients requiring lithotomy position are also put through similar trial. Such patients who cannot withstand the classical lithotomy position are operated in modified lithotomy, without flexion at the hip and knee joints
- While “proning” neurosurgical patients, extreme care has to be taken. At times, the neurosurgeons request the anesthesiologists to intubate the patient awake using fiberoptic scopes, prone them (while the patient continues to be awake), and then administer the anesthetic. This technique requires coordination of several members of the surgical and anesthesia teams^[13,14]
- Silicone gel pads are routinely used as cushions to protect the patient’s pressure points. It is also mentioned in the protocol that it is the duty of the anesthesiologists to prevent position-related injuries during anesthesia and surgery.

Induction of anesthesia

Induction of general anesthesia is one of the crucial phases while anesthetizing a patient. Although the number of agents available for intravenous induction is few, it is important to note the subtle variations that one may have to use in response to the patient’s existing conditions. The protocol helps newcomers in making choice between intravenous and inhalational induction. For a couple of decades, the authors use inhalational anesthetic agents; usage of intravenous agents is of course rare among cardiac anesthesiologists at the author’s institute. This chapter also assists newcomers in administering the adjunct medications to induction such as opioids, neuromuscular blocking agents, proton pump inhibitors, and anti-emetics among others.

Maintenance of anesthesia

The anesthetic technique at the Fortis Hospital is fairly standardized. The maintenance of general anesthesia invariably involves the infusion of opioid (fentanyl) and neuromuscular blocking agent (rocuronium or atracurium). The type of the infusion varies from one subspecialty to another. In the author’s view, administering neuromuscular blocking agents and opioid medications prevents inadvertent movement of the patient and possibility of awareness under general anesthesia. The choice of the inhalational anesthetic agent during maintenance is also mentioned in the protocol. The anesthesiologists at our institute are advised to use sevoflurane or isoflurane in general. In obese patients, day care surgeries and in elderly, usage of desflurane is advised.^[20,21]

Reversal of neuromuscular blocking agent

About 30–40% of the surgeries carried out at our institution require postoperative elective ventilation. The authors recommend reversal with intravenous administration 50 mcg/kg neostigmine and 5 mcg/kg glycopyrrolate. Reversal is not administered to patients scheduled for elective mechanical ventilation.^[22-24]

Extubation

Extubation is planned whenever elective postoperative ventilation is not planned. The criteria for extubating patient’s trachea are also defined. The rule of thumb for the beginners is – when in doubt, do not extubate; intubate if already not done so. It is also mentioned in the protocol that one should take time to extubate a patient whose intubation was difficult. It is advised that extubation in a patient whose intubation was difficult is preferably carried out when most senior members of the department are available.

Transfer out of patient

All the patients are transferred out of the operation theater while monitoring ECG, SaO₂ in extubated patients, and invasive arterial pressures in addition to the above in patients who are scheduled for elective postoperative ventilation. In the absence of an indwelling arterial cannula, noninvasive blood pressure monitoring is carried out during the transfer of patients. Hemodynamic unstable patients are accompanied by senior members of the staff as well.^[25,26] Such patients are transferred to the medical intensive care unit at our facility. All others were transferred to postanesthesia care unit.^[27,28] Patients who develop hemodynamic instability in the postanesthesia care unit are transferred to the medical intensive care unit.^[29-30,1]

Postoperative pain relief plan

Postoperative pain relief is an additional responsibility of the anesthesiologist. The postoperative pain relief is ordered while the patient is being transferred out of the operation theater. Whenever an indwelling catheter is *in situ*, an infusion using a silastic pump is advised. We use 0.1–0.2% ropivacaine solution to offer pain relief.^[2,3]

At the time when the protocols were written, anesthesia procedure for children undergoing computerized tomography/magnetic resonance imaging/endoscopy/bronchial and tracheal endoscopic surgery was occasionally performed. We are writing protocols for anesthetic management of these cases to standardize the anesthetic technique. The authors are also in the process of writing the protocol for the management of renal transplant surgery and major urological cases.

SUMMARY

It appears that making anesthesia protocol may not only be important from the point of standardization of anesthetic technique but also helps the anesthesiologists to have a benchmark. It is the author’s sincere opinion that by preparing the protocol, errors of omission and commission will become apparent. The author suggests that anesthesiologists interested in making protocols should use the general guidelines given here to make their customized protocols. It is clear that all health-care delivery systems will not be able to run on a protocol made by yet another facility. It is, therefore, strongly recommended that one should make “one’s own” protocol.

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Conflicts of interest

There are no conflicts of interest.

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