I have the pleasure to preface the 2022 Rwanda Standards Treatment Guidelines and the Essential Medicines List (STGs/EML). This is the second edition after the 2013 STGs and 2015 EML.

The development of the STGs/EML is an essential part of the improvement of the quality of health care delivery especially at the primary healthcare level. Rwanda is committed to the attainment of the 2030 SDGs and especially goal 3 i.e. “good health and well-being” with one its target to “Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all”

To attain the above-mentioned goals, special packaging of policies and strategies aligned to the Global Strategy for Women’s, Children’s and Adolescent’s Health were developed through the MNCH strategic plan 2018-2024 ensuring coordinated action to address cross-cutting health needs of our future. These guidelines have therefore integrated this plan accordingly.

Equally important, this 2022 STGs/EML integrates Rwanda’s global commitment to the implementation of the One Health Policy that set-up policies, implementation strategies to prevent and control zoonotic diseases, plant diseases, food safety and specifically antimicrobial resistance. Rwanda has therefore set up a One Health Multi-sectoral Coordination Mechanism (OH-MCM) that will allow antimicrobial resistance surveillance, guide and monitor the use of antibiotics in Rwanda. This policy is in line with our commitment to the WHO Global Action Plan on Antimicrobial Resistance (2018). We have therefore for the first time customized the WHO AWARE classification of antibiotics as well as the antibiotics prescription guidance. This will help not only reduce the current trend of antimicrobial resistance but importantly ensure better quality of healthcare of our population by reducing the negative impact of multi-drug resistance in Rwanda.

While the above global commitments inform our strategic choices, the STGs/EML are grounded first and foremost in our national diseases burden and specifically at the primary health care level. It is our hope that these guidelines will bring more evidence-based practice, more transparency in the care provision as well as access to efficient, affordable, and available medications in the country.

I would finally wish to acknowledge the strategic technical and financial contribution of the WHO that made this work possible despite the challenging environment due to Covid-19 pandemic. This work would not have been possible without the active involvement of the professional medical/pharmacy societies/associations, that reviewed the literature, held numerous online discussions, peer-reviewed several drafts and came up with the most suitable guidelines. Several other partners provided support to this project in one way or another and I wish to thank all of them for their usual support.

Dr. NGAMije M. Daniel,
Minister of Health
Acknowledgement

The Ministry of Health wishes to acknowledge the support of various stakeholders in the making of the 2022 Standards Treatment Guidelines (STGs) and Essential Medicines List (EML). Without their contributions, it wouldn’t have been possible to complete this work despite the restrictions made necessary by the Covid-19 Pandemics.

The World Health Organization availed the required financial and technical support throughout the project and was flexible to adjust to the challenges brought about by the stringent environment.

World AIDS Campaign International (WACI) Health made a significant financial input to allowing a smooth running of the project.

The Medicines, Technologies, and Pharmaceutical services program (USAID MTaPS) financial intervention especially in the shaping of the rational use of antibiotic guidelines has been a great input in the current work.

Clinton health access initiative (CHAI) have been instrumental and played a major role especially in developing the Clinical guidelines for hypoxemia screening and oxygen therapy administration in Neonates, children and adults.

The Ministry wishes to thank specifically all Rwanda Health professionals and Pharmacy Societies and Associations for their self-less spirit and gave their time to patiently review and update the previous 2013 STGs and 2015 EML spending very long hours online very often late in the night.

The Ministry of Health wishes to acknowledge and thank the consultants, Prof Emile Rwamasirabo, Dr. Raymond Muganga and Dr. Richard Butare who coordinated this 2022 STG/EML updates.

The Ministry also recognizes the important contribution of tertiary Hospitals including CHUK, CHUB and KFH that availed their microbiology data over 5 to 7 years that helped to profiling the antimicrobial resistance in Rwanda.
Special recognition goes also to the Experts Taskforce appointed by the MOH upon recommendation by the Medical and Pharmacy Societies and Associations. The team is composed as follows:

<table>
<thead>
<tr>
<th>Societies and Associations</th>
<th>Coordinators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The Rwanda Pediatric Association (RPA)</td>
<td>Prof. Musiime S.</td>
</tr>
<tr>
<td>2 The Rwanda College of Physicians (RCP)</td>
<td>Dr. Muvunyi B.</td>
</tr>
<tr>
<td>2 The Rwanda Society of Obstetrics and Gynecology (RSOG)</td>
<td>Dr. Ruzigana G.</td>
</tr>
<tr>
<td>3 The Rwanda Surgical Society</td>
<td>Dr. Byiringiro F.</td>
</tr>
<tr>
<td>4 The Rwanda Psychiatric Society</td>
<td>Dr. Mudenge C.</td>
</tr>
<tr>
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<td>Dr. Bizimana A.</td>
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<td>Dr. Mutangana F.</td>
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<td>Dr. Rubagumya F.</td>
</tr>
<tr>
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</tr>
<tr>
<td>9 The Rwanda Dermatology Society (RDS)</td>
<td>Dr. Amani A.</td>
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<tr>
<td>10 The Rwanda Society of Anesthesiologists (RSA)</td>
<td>Dr. Rudakemwa A.</td>
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<tr>
<td>11 The National Pharmacy Council</td>
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</tr>
</tbody>
</table>
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List of Abbreviation and acronyms

ACLs: Advanced Cardiac Life Support
BLS: Basic Life Support
BMI: Body Mass Index
CAD: Coronary Artery Disease
COPD: Chronic Obstructive Pulmonary Disease
DCP: Disease Control Priorities
DH: District Hospital
DIC: Disseminated intravascular coagulopathy
DM: Diabetes Mellitus
ECMO: Extra Corporeal Membrane Oxygenation
ECG: Electrocardiogram
EF: Ejection Fraction
HDU: High Dependent Unit
ICU: Intensive Care Unit
ISO: International Organization for Standards
MI: Myocardial Infarction
NPA: Non-Physicians Anesthetists
NSOAP: National Surgical, Obstetric, and Anaesthesia Plan
OR: Operating Room
PACU: Post-Anesthesia Care Unit
PCA: Patient-Controlled Analgesia
PCEA: Patient-Controlled Epidural Analgesia
PH: Provincial Hospital
RAHPC: Rwanda Allied Health Professions Council
RANPA: Rwanda Association for Non-Physician Anesthetists
RH: Referral Hospital
RMDC: Rwanda and Dental Medical Council
RSA: Rwanda Society of Anesthesiologists
TH: Teaching Hospital
WHO-WFSA: World Health Organization-World Federation of Societies of Anesthesiologists
Summary

These Standards were developed by the Rwanda Society of Anesthesiologists (RSA) in collaboration with the Rwanda Association of Non-Physician Anesthetists (RANPA) with the goal to ensure a Safe Practice of Anesthesia across Rwandan health facilities.

The recommendations were adapted to the Rwandan context from the 2018 World Health Organization-World Federation of Societies of Anaesthesiologists (WHO-WFSA) and International Federation of Nurse Anesthetists (IFNA) standards.

The Standards are applicable to all anesthesia providers and health facilities throughout Rwanda. They are intended to provide guidance to anesthesia providers, health facility administrators, and policy makers at local and national level for maintaining and improving the quality and safety of anesthesia care. The Standards cover professional aspects; facilities and equipment; medications and intravenous fluids; monitoring; and the conduct of anesthesia.

HIGHLY RECOMMENDED standards, the functional equivalent of mandatory standards, include (amongst other things): the continuous presence of a trained and vigilant anesthesia provider; continuous monitoring of tissue oxygenation and perfusion by clinical observation and a pulse oximeter; intermittent monitoring of blood pressure; confirmation of correct placement of an endotracheal tube (if used) by auscultation and carbon dioxide detection; the use of the WHO Safe Surgery Checklist; and a system for transfer of care at the end of an anesthetic. The RSA Standards represent minimum standards and the goal should always be to practice to the highest possible standards, preferably exceeding the standards outlined in this document.
INTRODUCTION

The anesthesia safety has improved significantly in the last few decades. However, there is still a big disparity of practice between high and low- and middle-income countries and within the same countries or between anesthesia providers especially in resource-limited settings where standards are not set or fully implemented. With evidence-based practice implemented, the anesthesia-related mortality has decreased from 2 per 10,000 to 1 in 200,000 in high-income countries while the numbers are as high as 1 in 300 for some low-and middle-income countries probably owing to the lack of standardized practice among other factors.\textsuperscript{1, 2}

These improvements of anesthesia safety in high-income countries resulting mainly from the implementation of high standards of anesthesia care dated from 1980s.\textsuperscript{1} The World Federation of Societies of Anaesthesiologists (WFSA) published the first International Standards for a Safe Practice of Anesthesia in 1992.\textsuperscript{3}

The Rwanda Society of Anesthesiologists (RSA) as a member of the WFSA, has endorsed the International Standards for a Safe Practice of Anesthesia which were reviewed and published respectively in 2010 and 2018.\textsuperscript{4, 5} Also, the Rwanda Association of Non-Physician Anesthetists as member of the IFNA has endorsed its revised Code of Ethics, Standards of Practice, Monitoring, and Education was fully adapted to the professional roles of nurse anesthetists.\textsuperscript{6}

In order to contribute to the Rwanda National Surgical, Obstetric, and Anaesthesia Plan (NSOAP) goal to have safe anesthesia and surgery, the WFSA standards need to be adapted to the Rwandan context owing to the unique challenges including lack of enough anesthesiologists and limited resources.\textsuperscript{7, 11} These first RSA standards are developed with strong consideration of the local context and aim to guide the safe practice of anesthesia with available resources while building and advocating more evidence-based capacity to sustain this safe practice.
--- | Principles

These standards are guided by the following principles:

a) Access to safe anesthesia for essential surgery is a basic human right and should be readily and 24hours/7days available at all health facilities conducting surgery in Rwanda.

b) They are intended to provide guidance to anesthesia providers, their anesthesia departments, and facility administrators for maintaining and improving the quality and safety of anesthesia care.

c) These standards apply to all anesthesia providers and health facilities conducting surgery and anesthesia in Rwanda

d) We have used the World Health Organization (WHO) levels of standards including HIGHLY RECOMMENDED, RECOMMENDED, and SUGGESTED. The goal in each facility should be to practice at the highest possible standards.

--- | Key definitions

HIGHLY RECOMMENDED standards are the minimum expected standards. They are the functional equivalent of mandatory standards. These standards should be practiced by any health facility or anesthesia provider conducting anesthesia in Rwanda.

a) RECOMMENDED standards should be practiced when resources allow and if appropriate for the healthcare being provided. These standards should be practiced by health facilities or anesthesia providers taking care of complex patients or complex procedures at Referral and Teaching Hospitals.

b) SUGGESTED standards should be practiced when resources allow and if appropriate for the healthcare being provided. These standards should be practiced by health facilities or anesthesia providers taking care of very complex patients or sub-specialized procedures at Teaching Hospitals.

c) The types of anesthesia providers allowed to provide anesthesia in Rwanda include anesthesiologists, anesthesia residents, and non-physician anesthetists. The definition of each anesthesia provider is described in Table 1.
d) The type of facilities providing anesthesia in Rwanda include District/Provincial Hospitals, Referral Hospitals, and Teaching Hospitals. The characteristic of each facility is described in Table 2. This classification came from the Disease Control Priorities, third edition (DCP-3) (http://dcp-3.org/surgery) and the 2018 WHO-WFSA international standards for a safe practice of anesthesia.5,7

e) The type of anesthesia services provided in different facilities in Rwanda include sedation, general anesthesia, pediatric anesthesia, obstetric anesthesia, regional anesthesia, anesthesia for sub-specialties, Acute Pain Service, and Critical Care Medicine

The details of anesthesia services provided in Rwanda are described in Table 3.

---

**Scope of standards**

These standards are relevant to any healthcare facility anywhere in Rwanda, independent of level designated (including private clinics), in which general anesthesia, deep sedation, moderate, or minimal sedation is used or regional anesthesia (spinal, epidural, major limb blocks) is administered.

a. Assessment of and titration to the exact level of sedation can be difficult and the same standards therefore apply to minimal, moderate, and deep sedation as to general anesthesia. As better-quality sedatives become widely available, less requirements may be recommended in the near future for minimal sedation where there is normal response to verbal stimulus.

b. The standards do not apply to locations where only superficial procedures involving local anesthesia (i.e: infiltration of local anesthetics) are performed.

c. These Standards should be reviewed and revised frequently as anesthetic practice advances in Rwanda or as new evidence for best practice arises.
### Table 1: Type of anesthesia providers allowed providing anesthesia in Rwanda.

<table>
<thead>
<tr>
<th>Anesthesia Providers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesiologist</td>
<td>A graduate of a medical school who has completed a nationally recognized specialist anesthesia residency program.</td>
</tr>
<tr>
<td>Anesthesia Resident</td>
<td>A graduate of a medical school who is undergoing training in a nationally recognized specialist anesthesia residency program. A Junior resident has completed less than 2 years while a senior resident has completed at least 2 years of training.</td>
</tr>
<tr>
<td>Non-Physician Anesthetist</td>
<td>A graduate of a non-physician anesthetist school who has completed a nationally recognized (or equivalent) non-physician anesthetist training program.</td>
</tr>
</tbody>
</table>
Table 2: Type of facilities allowed providing anesthesia in Rwanda.

<table>
<thead>
<tr>
<th>Health Care Facility Levels</th>
<th>District/ Hospital</th>
<th>Provincial Hospital</th>
<th>Referral Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infrastructures</strong></td>
<td>100–300 beds, equipped major and minor ORs</td>
<td>100–300 beds, equipped major and minor ORs</td>
<td>300–1,000 or more beds, equipped ORs and intensive care facilities</td>
</tr>
<tr>
<td><strong>Treatment capacity</strong></td>
<td>Emergency treatment of 90–95% of trauma, acute abdomen and obstetric cases</td>
<td>Short-term treatment of 95–99% of major life threatening conditions</td>
<td>Same as Referral Hospitals, with the addition of intensive care treatment with some systemic replacement therapies</td>
</tr>
<tr>
<td><strong>Procedures</strong></td>
<td>Provision of the Bellwether Procedures (laparotomy, without resection, Cesarean delivery, treatment of open fracture) and a range of other emergency and elective surgery</td>
<td>Beyond District Hospital package Amputation, Hernia repair Tubal ligation, Closed fracture treatment and application of plaster of Paris, Eye operations, including cataract extraction, Removal of foreign bodies, eg, from the airway, Emergency ventilation and airway management for referred patients such as those with chest and head injuries. Minor neurosurgery but not up to Cardiothoracic</td>
<td>Beyond Provincial Hospital package as a Referral Hospital Subspecialty and more complex surgery. Facial and intracranial surgery Bowel surgery Pediatric and neonatal surgery Thoracic surgery Major eye surgery Major gynecologic surgery, eg, vesico-vaginal repair Intensive care treatment Systemic Replacement Therapy Diagnostic procedures (i.e endoscopy, colonoscopy, MRI..)</td>
</tr>
</tbody>
</table>
Table 3: Different anesthesia modalities provided within different health care facilities in Rwanda.

<table>
<thead>
<tr>
<th>Types of Anesthesia services</th>
<th>Sedation</th>
<th>General anesthesia</th>
<th>Pediatric anesthesia</th>
<th>Obstetric anesthesia</th>
<th>Regional anesthesia</th>
<th>Anesthesia for sub-specialties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimal, moderate, and deep sedation (consider OR as location for safety)</td>
<td>General anesthesia for essential surgery (Bellwether center)</td>
<td>For children more than 2 years old (unless in case of emergencies or presence of anesthesiologist)</td>
<td>Spinal and general anesthesia as appropriate.</td>
<td>Spinal anesthesia. Other blocks require the presence of Anesthesia provider with required knowledge and skills on blocks</td>
<td>Not recommended (unless in case of extreme emergencies or presence of appropriate teams i.e outreach and mission programs)</td>
</tr>
<tr>
<td></td>
<td>Minimal, moderate, and deep sedation</td>
<td>General surgery for a wider range of procedures</td>
<td>Anesthesia for both neonates and pediatric patients practiced by appropriately trained for Pead anesthesia</td>
<td>Spinal and general anesthesia as appropriate, Epidural if possible.</td>
<td>Spinal anesthesia. Other blocks require the presence of Anesthesia provider with required knowledge and skills on blocks</td>
<td>Not recommended (unless in case of extreme emergencies or presence of appropriate teams i.e outreach and mission programs)</td>
</tr>
<tr>
<td></td>
<td>Minimal, moderate, and deep sedation</td>
<td>General surgery for more complex procedures</td>
<td>Anesthesia for both neonates and pediatric patients for a wide range of basic and complex procedures</td>
<td>Upper and Lower limbs block, Different Plane blocks, Epidural and Combined Spinal/ Epidural.</td>
<td></td>
<td>Anesthesia for a wide range of complex sub-specialties (i.e neuro-surgery, thoracic, pediatric, orthopedics, Ear Nose and Throat, Gynecology, Bowel, etc)</td>
</tr>
<tr>
<td>Service</td>
<td>Acute Pain</td>
<td>Intensive Care Unit</td>
<td>Chronic Pain Service</td>
<td>Intensive Care Unit</td>
<td></td>
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<td>----------------------</td>
<td>---------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Should be available and led by the anesthesia department</td>
<td>Not recommended</td>
<td>Not recommended</td>
<td>Capacity for critical care services level 1 and 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Should be available and led by the anesthesia department</td>
<td>Recommended in the presence of trained Anesthesiologist</td>
<td>Capacity for Critical care level 3 and ICU level 1 with ventilating patients for 24-48 hours waiting for transfer.</td>
<td>A High Dependent Unit for patients requiring close monitoring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Should be available and led by the anesthesia department</td>
<td>Should be available and led by the anesthesia department</td>
<td>Recommended in the presence of trained Anesthesiologist</td>
<td>Should be available and led by appropriately trained personnel.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROFESSIONAL ASPECTS

--- Professional Status

Anesthesia is vital to health care delivery and needs appropriate human, technical and financial resources. Anesthesia is inherently risky and preparedness, anticipation and effective communication among the team players are essential for a safe practice. All anesthesia providers should have a high level of understanding of physiology, anatomy, pharmacology and practical skills to safely administer anesthesia. Anesthesia is to be provided by a qualified and trained Anaesthesia provider (anesthesiologist or non-physician anesthetists). Wherever possible, anesthesia practice should involve or be supervised by a qualified anesthesiologist. A resident under supervision of the anesthesiologist can provide anesthesia. The level of supervision (either in person or remote) will be decided by the responsible anesthesiologist based on the resident experience, patient characteristics, and complexity of the procedure. In a setting where there is no anesthesiologist, anesthesia can be provided by a qualified NPA according to his/her scope of practice. Patients should be safely cared regardless of the fore-mentioned provider (HIGHLY RECOMMENDED).

--- Professional Training

Adequate time and resources should be available for professional training to ensure standardized knowledge and skills to anesthesia providers. Certification of the training from an accredited university and continuous professional training are HIGHLY RECOMMENDED to qualify to safely provide anesthesia for routine practice in Rwanda.

--- Number of Anesthesia Providers

The ministry of health and health care institutions should ensure an adequate number of anesthesia providers is ready to meet the anesthesia need in hospitals for a Bellwether package (for district hospitals), Beyond Bellwether for Provincial Hospital and Specialized procedures for Referral Hospitals (HIGHLY RECOMMENDED). Two anesthesia providers should be
available during the critical stages of anesthesia mainly at induction and at emergency.

--- | Anesthesia Department Organization
The department of anesthesia should be an independent department, properly organized, directed, and integrated within the Clinical directorate with other departments in the health facility, and it should include all staff members who provide anesthetic services to patients for surgical, obstetric, diagnostic, and therapeutic purposes and those involved in acute perioperative pain management. The department should be staffed appropriately, bearing in mind the scope and nature of the uninterrupted and equal services provided by the healthcare facility all the time. The chief of the department should be an anesthesiologist where applicable. In health facilities without anesthesiologists, a non-physician anesthetist with appropriate experience (at least 3 years) should be appointed to lead the team.

--- | Main responsibilities of the Head of anesthesia department
a) To be aware of the current RSA/RANPA Standards to the Practice of Anesthesia and to ensure that written policies and guidelines with respect to the practice of anesthesia are established and enforced.
b) To evaluate the qualifications and abilities of the physicians providing anesthetic care as well as other health professionals providing ancillary care.
c) To ensure the quality of anesthetic care provided by members of the department of anesthesia. Techniques used may include chart audits, clinical indicator and outcome monitoring, adverse event reporting systems, morbidity and mortality conferences, and critical incident case reviews.
d) To ensure adequate record keeping for all anesthetic procedures.
e) To arrange liaison between the departments of anesthesiology, biomedical engineering, and information management services.
f) To advocate for an appropriate staffing and equipment for a safe anesthesia provision 24 hours/7 days and appropriate acute perioperative pain management.
--| Privileges in anesthesia

➤ Anesthesiologists
Anesthesiologists should demonstrate satisfactory completion of a nationally recognized (or equivalent) specialist postgraduate residency in anesthesia. Within health facilities staffed with anesthesiologists, the anesthesiologist should be the most responsible and accountable for the anesthesia provision (HIGHLY RECOMMENDED).

➤ Anesthesia Residents
Anesthesia residents who are undergoing training within a nationally recognized (or equivalent) specialist postgraduate residency in anesthesia provide anesthesia under supervision by anesthesiologist (HIGHLY RECOMMENDED). The degree of this supervision must consider the condition of each patient, the nature of the anesthetic service, and the experience and capabilities of the resident (increasing professional responsibility). At the discretion of the supervising anesthesiologist, residents may provide a range of anesthetic care with minimal supervision especially for those who successfully validated 5 semesters of training (senior residents).
In all cases, the supervising anesthesiologist must remain readily available (within less than 10 minutes) to give advice or assist the resident with urgent or routine patient care.

➤ Non-Physicians Anesthetists
Non-Physicians Anesthetists should demonstrate satisfactory completion of a nationally recognized (or equivalent) non-physician anesthetist training program. Within health facilities staffed with anesthesiologists, the latter supervise anesthesia practice done with Non-Physicians Anesthetists (RECOMMENDED). Non-physician anesthetist shall be accountable on anesthesia practice conducted alone.

Within health facilities without anesthesiologist, Non-Physicians Anesthetists may work independently following the Rwanda Non-Physicians Anesthetists’ scope of practice.

➤ Non-Physicians Anesthetists Students
Non-Physicians Anesthetists students who are undergoing training within
a nationally recognized (or equivalent) non-physician anesthetist training program, should provide anesthesia under supervision by anesthesiologist or a non-physician anesthetist (HIGHLY RECOMMENDED). The degree of this supervision must consider the condition of each patient, the nature of the anesthetic service, and the experience and capabilities of the student. All anesthesia providers should possess the knowledge and technical and non-technical skills necessary for the practice of a safe anesthesia.

Knowledge and technical skills include the ability:

To provide preanesthetic evaluation of the patient and determine the appropriate anesthetic management; however, preanesthetic consultation is conducted by the sole anesthesiologist or an anesthesia resident under the supervision of an anesthesiologist.

a) To render the patient insensible to pain for the performance of diagnostic and therapeutic procedures, surgical operations, and obstetric procedures;

b) To monitor and support the vital organ systems during the perioperative period;

c) To provide immediate post-anesthetic management of the patient;

d) To provide resuscitation and intensive care management when indicated.

Non-technical skills include:

a) Task management: planning and preparing, prioritizing, providing and maintaining standards, and identifying and utilizing resources;

b) Teamwork: coordinating activities with team members, exchanging information, using authority and assertiveness, assessing capabilities, supporting others, and supporting the World Health Organization Surgical Safety Checklist;

c) Situational awareness: anticipating, gathering information, recognizing, and understanding, and;

d) Decision-making: identifying options, balancing risks and selecting options, and re-evaluating.

-- | Quality Assurance

Institutional and/or national mechanisms should be instituted to provide an ongoing review of anesthetic practice based on the most recent evidence applicable in the local context.
Protocols and guidelines should be developed to ensure that individual and system-based deficiencies are identified and rectified in a non-punitive and constructive manner. Regular morbidity and mortality rounds involving a multidisciplinary team should be organized (RECOMMENDED). Regular outcomes reporting and quality improvement projects should be put in place (RECOMMENDED).

--- Workload

The schedule and workload should allow enough time for rest to avoid undue fatigue and physical demands (RECOMMENDED) (www.wfsahq.org/our-work/safetyquality). Time should be allocated for professional development, administration, research, and teaching (RECOMMENDED).
**FACILITIES AND EQUIPMENT**

--- | **Responsibilities of the healthcare facility**

Health facilities should ensure the availability of the following:

- a) Reliable delivery of oxygen at any appropriate concentration up to 100%
- b) Reliable means of positive pressure ventilation
- c) Backup ventilation equipment available and functioning
- d) Controlled release of positive pressure from the breathing circuit
- e) Anesthesia vapor delivery (if intended as part of the anesthetic plan)
- f) Adequate suction
- g) Means to conform to standards for patient monitoring

--- | **Waste gases 9**

Recommendations for reducing occupational exposure to waste anesthetic gases:

- a) Recirculation of exhaust air in the operating room shall not be permitted at any time.
- b) Wherever an anesthetic delivery system is used, a scavenger shall be provided to capture anesthetic gases that might be released from the anesthetic circuit or ventilator.
- c) A maintenance program shall be established in each healthcare facility to detect and repair leakage from the anesthetic delivery system and to maintain the effectiveness of the waste anesthetic scavenging unit.
- d) The healthcare facility shall be responsible for conducting regular monitoring of exposure to waste anesthetic gases. The monitoring protocol should include individuals and the air flow patterns of the rooms being assessed.
**Table 4: Standards for anesthesia facilities and equipment.**

<table>
<thead>
<tr>
<th>Standards for Facilities and Equipment (also see Table 5)</th>
<th>District Hospital</th>
<th>Provincial Hospital</th>
<th>Referral Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative area</td>
<td>HIGHLY RECOMMENDED Dedicated space for preoperative assessment</td>
<td>HIGHLY RECOMMENDED Dedicated space for preoperative assessment</td>
<td>HIGHLY RECOMMENDED Dedicated space for preoperative assessment</td>
</tr>
<tr>
<td>Operating room</td>
<td>HIGHLY RECOMMENDED Adequate lighting</td>
<td>Same as the District/Provincial Hospital.</td>
<td>Same as the Referral Hospital.</td>
</tr>
<tr>
<td></td>
<td>● Tilting operating table</td>
<td>Plus the following: RECOMMENDED</td>
<td>Plus the following: SUGGESTED</td>
</tr>
<tr>
<td></td>
<td>● Supply of oxygen (e.g., oxygen concentrator, cylinders or pipeline)</td>
<td>● Work surface and storage for equipment and medications</td>
<td>● Infusion pumps</td>
</tr>
<tr>
<td></td>
<td>● Oropharyngeal airways</td>
<td>● System for delivering inhalational anesthesia (plenum)</td>
<td>● Warming blanket</td>
</tr>
<tr>
<td></td>
<td>● Facemasks</td>
<td>● Inhalational anesthetic</td>
<td>● Overhead heater (for neonates)</td>
</tr>
<tr>
<td></td>
<td>● System for delivering inhalational anesthesia (plenum)</td>
<td>● Adult and pediatric supraglottic airways</td>
<td>● Infant incubator</td>
</tr>
<tr>
<td></td>
<td>● Inhalational anesthetic</td>
<td>● Laryngoscope and appropriate sized</td>
<td>● Intensive care ventilator</td>
</tr>
<tr>
<td></td>
<td>● Adult and pediatric supraglottic airways</td>
<td>laryngoscope blades for both adult and pediatric patients</td>
<td>● Concentration monitor</td>
</tr>
<tr>
<td></td>
<td>● Laryngoscope and appropriate sized</td>
<td>Appropriate sized endotracheal tubes for adult, and pediatric patients</td>
<td>● Intra-arterial blood pressure monitor</td>
</tr>
<tr>
<td></td>
<td>laryngoscope blades for both adult and pediatric patients</td>
<td>Intubation aids (e.g., Magill forceps, bougie, stylet)</td>
<td>● Temperature monitor (continuous electronic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suction device and suction catheters</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adult and pediatric self-inflating bags</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equipment for IV infusions and injection of medications for adult and pediatric patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equipment for spinal anesthesia or regional blocks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sterile gloves</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Access to a defibrillator</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stethoscope</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pulse oximeter</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carbon dioxide detector</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Noninvasive blood pressure monitor with appropriate sized cuffs for adult and pediatric patients</td>
<td></td>
</tr>
</tbody>
</table>
### Post-anesthesia recovery area

**HIGHLY RECOMMENDED**
- Adequate lighting
- Supply of oxygen (eg, oxygen concentrator, cylinders or pipeline)
- Suction device and suction catheters
- Facemasks
- Adult and pediatric self-inflating bags
- Electrocardiography
- Access to a defibrillator
- Pulse oximeter
- Noninvasive blood pressure monitor with appropriate sized cuffs for adult and pediatric patients
- Dedicated space for recovering patients
- Examination gloves (nonsterile)
- Temperature monitor (intermittent)

**HIGHLY RECOMMENDED**
- Adequate lighting
- Supply of oxygen (eg, oxygen concentrator, cylinders or pipeline)
- Suction device and suction catheters
- Facemasks
- Adult and pediatric self-inflating bags
- Electrocardiography
- Access to a defibrillator
- Pulse oximeter
- Noninvasive blood pressure monitor with appropriate sized cuffs for adult and pediatric patients
- Dedicated space for recovering patients
- Examination gloves (nonsterile)
- Temperature monitor (intermittent)

MEDICATIONS AND INTRAVENOUS FLUIDS 5

Adequate quantity of medications, intravenous fluids, appropriate anesthetic, analgesic, resuscitative, and other (adjuvant) medications should be available in healthcare facilities. The medications listed in Table 6 are a minimum and should be readily available for safe practice of anesthesia. The WHO Essential Medicines List serves as a guide to the minimum medications that should be available (http://www.who.int/medicines/publications/essentialmedicines/en/).

All medications should be clearly labelled and dated (HIGHLY RECOMMENDED). Use of the ISO standard coloured medication labels is SUGGESTED (www.iso.org/standard/43811.html).

Supplemental oxygen is HIGHLY RECOMMENDED for all patients undergoing general anesthesia and sedation.

MONITORING 12-15

Patient safety is the legacy of modern anesthesia. Patient monitoring should be done wherever anesthesia is provided.

--- | Trained Anesthesia provider
The most important monitor is a trained and vigilant anesthesia provider. He/she should be continuously present in the operating or procedure room during anesthetic until recovery of consciousness or until care is transferred to another trained healthcare worker. HIGHLY RECOMMENDED

--- | Clinical Observation
Continuous clinical observation (eg, a finger on the pulse, direct observation of the patient, precordial stethoscope) is an essential component of monitoring an anesthetized patient. Clinical observation allows earlier detection of clinical deterioration than monitoring equipment. RECOMMENDED
-- Audible alarms

Available audible signals, such as the variable pitch pulse tone of the pulse oximeter, with appropriately set alarm limits, should be activated at all times and loud enough to be heard throughout the operating room.

Standards 1: Qualified anesthesia personnel shall be present in the room throughout the conduct of all general anesthetics, regional anesthetics, sedation and monitored anesthesia care. **HIGHLY RECOMMENDED**

Standards 2: During all anesthetics, the patient’s oxygenation, ventilation, circulation and temperature shall be continually evaluated. Required monitors include: Continuous SpO₂, ECG, BP, End-tidal CO₂, and Temperature. **HIGHLY RECOMMENDED**

*Figure 1: Essentials for safe patient care during anesthesia in any setting.*
Table 6: Standards for monitoring.

<table>
<thead>
<tr>
<th>Standards for Monitoring</th>
<th>District Hospital</th>
<th>Provincial Hospital</th>
<th>Referral Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intraoperative</strong></td>
<td>Qualified anaesthesia provider</td>
<td>Qualified anaesthesia provider</td>
<td>Qualified anaesthesia provider</td>
</tr>
<tr>
<td></td>
<td>Stethoscope</td>
<td>Stethoscope</td>
<td>Stethoscope</td>
</tr>
<tr>
<td></td>
<td>Non-invasive blood pressure</td>
<td>Non-invasive blood pressure</td>
<td>Non-invasive blood pressure</td>
</tr>
<tr>
<td></td>
<td>Pulse oximeter</td>
<td>Pulse oximeter</td>
<td>Pulse oximeter</td>
</tr>
<tr>
<td></td>
<td>Capnography</td>
<td>Capnography</td>
<td>Capnography</td>
</tr>
<tr>
<td></td>
<td>Electrocardiogram</td>
<td>Temperature measurement (intermittent)</td>
<td>Temperature measurement (intermittent)</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>Electrocardiogram</td>
<td>Electrocardiogram</td>
</tr>
<tr>
<td></td>
<td>measurement</td>
<td>Inspired oxygen concentration alarm</td>
<td>Inspired oxygen concentration alarm</td>
</tr>
<tr>
<td></td>
<td>(intermittent)</td>
<td>Airway and disconnect alarms</td>
<td>Airway and disconnect alarms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peripheral nerve stimulator</td>
<td>Peripheral nerve stimulator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Urine output</td>
<td>Urine output</td>
</tr>
</tbody>
</table>

| **Postoperative**        | Qualified anaesthesia provider or PACU nurse | Qualified anaesthesia provider or PACU nurse | Qualified anaesthesia provider or PACU nurse |
|                          | Non-invasive blood pressure | Non-invasive blood pressure | Non-invasive blood pressure |
|                          | Pulse oximeter            | Pulse oximeter            | Pulse oximeter            |
|                          | Electrocardiogram         | Electrocardiogram         | Electrocardiogram         |
|                          | urine output              | urine output              | urine output              |
|                          | Temperature measurement (intermittent) | Temperature measurement (intermittent) | Temperature measurement (intermittent) |
CONDUCT OF ANESTHESIA

-- Personnel

a) The anaesthesia provider should be dedicated to each patient and be immediately present throughout each anaesthetic (general, sedation, regional). **HIGHLY RECOMMENDED**

b) An Anaesthesia provider should be responsible for the transport of the patient to the PACU and the transfer of care to appropriately trained personnel. **HIGHLY RECOMMENDED**

c) The Anaesthesia provider should retain overall responsibility for the patient during the recovery period and should be readily available for consultation until the patient has made an adequate recovery. **HIGHLY RECOMMENDED**

d) If responsibility for care is transferred from one Anaesthesia provider to another, a “handover protocol” should be followed, during which all relevant information about the patient’s history, medical condition, anesthetic status, and plan should be communicated. **HIGHLY RECOMMENDED**

e) The anaesthesia provider should ensure, if all aspects of direct care are delegated before, during, or after an anaesthetic, that the person to whom responsibility is delegated is both suitably qualified and conversant with relevant information regarding the anaesthetic and the patient. **HIGHLY RECOMMENDED**

-- Preoperative testing

Preoperative tests are very beneficial as they provide additional information that cannot be obtained from a patient history and physical examination alone.

They are also used to predict postoperative complications and to assess the risk benefits of surgery. This can help the anesthetist and surgeon to make decisions regarding the course of treatment and pre and / or post-operative management. Perioperative tests can sometimes be ordered unnecessarily, this can cause delays in treatment and inefficiency in planning
surgical care. Inappropriate ordering of routine preoperative tests can also lead to high costs of health care. It aims to reduce unnecessary testing by providing guidance on which tests to offer before minor, intermediate and major or complex surgery.

--- | **Procedure grading and patients classifications**

**Table 7: Surgical grades**

<table>
<thead>
<tr>
<th>Surgical Grades</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Minor             | Excision of skin lesion  
|                   | Myringotomy tubes  
|                   | Hysteroscopy  
|                   | Endoscopy/Colonoscopy                                                   |
| Intermediate      | Hernia Repair  
|                   | Laparoscopic Cholecystectomy  
|                   | Arthroscopy  
|                   | Tonsillectomy                                                           |
| Major or Complex  | Total abdominal hysterectomy  
|                   | TURP  
|                   | Thyroidectomy  
|                   | Joint replacement  
|                   | Colonic resection  
|                   | Craniotomy  
|                   | Spine surgery                                                          |
### Table 8: ASA classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Definition</th>
<th>Adult examples</th>
<th>Pediatric examples</th>
<th>Obstetric examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA 1</td>
<td>A normal healthy patient</td>
<td>Healthy, non-smoking, no or minimal alcohol use</td>
<td>Healthy (no acute or chronic disease), normal BMI percentile for age</td>
<td>Normal pregnancy, well controlled gestational HTN, controlled pre-eclampsia without severe features, diet-controlled gestational DM.</td>
</tr>
<tr>
<td>ASA 2</td>
<td>A patient with mild systemic disease</td>
<td>Current smoker, social alcohol drinker, pregnancy, obesity (30&lt;BMI&lt;40), well-controlled DM/HTN, mild lung disease</td>
<td>Asymptomatic congenital cardiac disease, well controlled dysrhythmias, asthma without exacerbation, well controlled epilepsy, non-insulin dependent diabetes mellitus, abnormal BMI percentile for age, mild/moderate OSA, oncologic state in remission, autism with mild limitations</td>
<td></td>
</tr>
<tr>
<td>ASA 3</td>
<td>A patient with severe systemic disease</td>
<td>Substantive functional limitations; One or more moderate to severe diseases. Poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, history (&gt;3 months) of MI, CVA, TIA, or CAD/stents.</td>
<td>Uncorrected stable congenital cardiac abnormality, asthma with exacerbation, poorly controlled epilepsy, insulin dependent diabetes mellitus, morbid obesity, malnutrition, severe OSA, oncologic state, renal failure, muscular dystrophy, cystic fibrosis, history of organ transplantation, brain/spinal cord malformation, symptomatic hydrocephalus, premature infant PCA &lt;60 weeks, autism with severe limitations, metabolic disease, difficult airway, long term parenteral nutrition. Full term infants &lt;6 weeks of age.</td>
<td>Preeclampsia with severe features, gestational DM with complications or high insulin requirements, a thrombophilic disease requiring anticoagulation.</td>
</tr>
</tbody>
</table>
### ASA 4
A patient with severe systemic disease that is a constant threat to life
- Recent (<3 months) MI, CVA, TIA or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, shock, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis
- Symptomatic congenital cardiac abnormality, congestive heart failure, active sequelae of prematurity, acute hypoxic-ischemic encephalopathy, shock, sepsis, disseminated intravascular coagulation, automatic implantable cardioverter-defibrillator, ventilator dependence, endocrinopathy, severe trauma, severe respiratory distress, advanced oncologic state.

### ASA 5
A moribund patient who is not expected to survive without the operation
- Ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction
- Massive trauma, intracranial hemorrhage with mass effect, patient requiring ECMO, respiratory failure or arrest, malignant hypertension, decompenated congestive heart failure, hepatic encephalopathy, ischemic bowel or multiple organ/system dysfunction.
- Uterine rupture.

Adapted from
https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system

## Preoperative tests

### Table 9: Minimal investigations for minor surgery

<table>
<thead>
<tr>
<th>Test</th>
<th>ASA 1</th>
<th>ASA 2, 3</th>
<th>ASA 4, 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete blood count</td>
<td>Not Routinely</td>
<td>Consider for people with cardiovascular or renal disease if any symptoms not recently investigated</td>
<td>Yes</td>
</tr>
<tr>
<td>Test</td>
<td>ASA 1</td>
<td>ASA 2, 3</td>
<td>ASA 4, 5</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------</td>
<td>----------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Coagulation screen</td>
<td>Not Routinely</td>
<td>Not Routinely</td>
<td>Consider in patients with chronic liver disease</td>
</tr>
<tr>
<td>Renal Function</td>
<td>Not Routinely</td>
<td>Consider in patients at risk of AKI</td>
<td>Yes</td>
</tr>
<tr>
<td>EKG</td>
<td>Not Routinely</td>
<td>Not Routinely</td>
<td>Consider in patients with diabetes, cardiovascular or renal co-morbidities</td>
</tr>
<tr>
<td>Spirometry</td>
<td>Not Routinely</td>
<td>Not Routentially</td>
<td>Yes, if respiratory disease contributing to ASA status</td>
</tr>
</tbody>
</table>

**Table 10. Minimal investigations for intermediate surgery**
Table 11: Minimal investigations for major or complex surgery

<table>
<thead>
<tr>
<th>Test</th>
<th>ASA 1</th>
<th>ASA 2, 3</th>
<th>ASA 4, 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Coagulation screen</td>
<td>Not Routinely</td>
<td>Consider in patients with chronic liver disease</td>
<td>Yes</td>
</tr>
<tr>
<td>Renal function</td>
<td>Consider in patients at risk of AKI</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>EKG</td>
<td>Consider for people aged over 60 years old</td>
<td>Consider in patients with diabetes, cardiovascular or renal co-morbidities</td>
<td>Yes</td>
</tr>
<tr>
<td>Spirometry</td>
<td>Not Routinely</td>
<td>Not Routinely</td>
<td>Yes, if respiratory disease contributing to ASA status</td>
</tr>
</tbody>
</table>

Recommendations for specific test

a) Chest X-ray
Should not be routinely performed before surgery.
Consider chest radiography for:
- Patients who smoke
- Patients with chronic obstructive pulmonary disease
- Patients with cardiac disease.

b) Echocardiography
Should not be ordered routinely.
Consider echocardiography for:
- Patients with cardiac history
- Patients with unexplained breathlessness or poor exercise tolerance
- The patient with a murmur
- Patients with abnormal ECGs
- Patients with unexplained chest pain.

Note: Further testing may be requested based on the patient’s condition or on the advice of other experts including cardiologists, hematologists, endocrinologists, intensivists, oncologists, etc.
Pre-anesthetic Assessment and Consent\textsuperscript{5,18,20}

Definition of pre-anesthesia evaluation

Pre-anesthesia evaluation is defined as the process of clinical assessment that precedes the delivery of anesthesia care for surgery and for nonsurgical procedures. The preanesthetic evaluation is the responsibility of the anesthesiologist or the qualified non-physician anesthetist. Pre-anesthesia evaluation consists of the consideration of information from multiple sources that may include the patient’s medical records, interview, physical examination, and findings from medical tests and evaluations. As part of the pre-anesthesia evaluation process, the anesthesia provider may choose to consult with other healthcare professionals to obtain information or services that are relevant to perioperative anesthetic care.

Review by an anaesthetist is important for the following reasons:

- To create rapport with the patient or their parent/guardian
- To understand the patient’s medical history and ensure that the patient’s condition has been optimized before surgery.
- To prepare an anaesthetic plan suitable for the patient and the planned surgery
- To obtain informed consent for the planned anaesthetic techniques.

The assessment of anesthetic risks associated with the patient’s medical conditions, therapies, alternative treatments, surgical and other procedures, and of options for anesthetic techniques is an essential component of basic anesthetic practice.

Benefits may include, but are not limited to, the safety of perioperative care, optimal resource use, improved outcomes, and patient satisfaction.

Pre-anesthesia evaluation

The pre-anesthesia evaluation should start as soon as the decision to operate is taken in order to allow enough time for patient optimization. The information on aspects that may influence perioperative decisions may be obtained by reviewing the medical record, as well as taking a focused history and physical examination of the patient.
This should focus on (but is not limited to):

a) General health, anesthetic and medical history,

b) Relevant medical history,

c) Pharmacology history, allergy and illicit/herbal drugs

d) Airway, heart, lung and brain assessment and examination,

e) Baseline vital signs measurement,

f) Full physical examination and back examination once neuraxial anesthesia is planned.

Under unusual circumstances, e.g., extreme emergencies, at a minimum, a focused preoperative evaluation of airway, lungs and heart must be carried out and vital signs documented.

The evidence interventions during pre-anesthesia evaluation are listed below:

- Pre-anesthesia History and Physical Examination
- Pre-procedure review of pertinent medical records
- Patient interviewing for medical or anesthetic history

*Patient interview*

Timing of preanesthetic assessment based on invasiveness of procedure and severity of disease Physical examination (minimum of airway, lungs, and heart), selective preoperative tests, decision making parameters (for specific preoperative tests and timing of tests).

*Airways evaluation*

- Signs of difficult bag mask ventilation
- Features of intubation
- Mallampati classes, Thyromental distance, mouth opening and neck mobility

*Cardiac Evaluation*

- Electrocardiogram
- Other cardiac evaluation (e.g., angiography, echocardiography, stress tests)
- Cardiac function tests
- Echocardiography (transoesophageal, transthoracic)
- Stress tests Ventriculography
**Pulmonary Evaluation**
- Chest radiography
- Other pulmonary evaluation (e.g., pulmonary function tests, spirometry)

**Pregnancy evaluation**
An anaesthesia provider, prior to surgery, shall review all patients scheduled for surgery. In the event of a time-critical, life-threatening emergency, the anaesthesia provider may waive this requirement.
At a minimum, a focused pre-anesthetic physical examination should include an assessment of the airway, lungs, and heart, with documentation of vital signs. In the event of life-threatening emergencies, where to insist on a review in the ward would lead to unacceptable delay and potential compromise to the patient, the anaesthetist will perform a quick assessment of the patient in theatre.

It is the obligation of the healthcare system to, at a minimum, provide pertinent information to the anesthesiologist for the appropriate assessment of the severity of medical condition of the patient and invasiveness of the proposed surgical procedure well in advance of the anticipated day of procedure for all elective patients.

The pre-operative assessment will include review of the patient’s notes, examination of the patient, and review of lab tests and relevant imaging. Any medication the patient is on will need to be confirmed by a review of the treatment sheet. The anaesthetist will be required to decide which medication should be stopped, what will need to be substituted for something else and what medication may safely be given even while the patient is fasting. If there are any concerns regarding a patient’s fitness for anaesthesia, the anaesthetist shall document these concerns in the patient’s notes and discuss the patient with the surgical team promptly.

Adult patients with co-existing medical problems will need to be reviewed and cleared by a physician or intensivists (and children by a pediatrician or paediatric intensivist), before surgery can proceed. However, the final decision as to whether or not to proceed with the anaesthetic will remain the anesthetist’s decision.
*Pre-anesthesia history and physical examination timing*

An assessment of readily accessible, pertinent medical records with consultations, when appropriate, should be performed as part of the pre-anesthetic evaluation before the day of surgery for procedures with high surgical invasiveness.

For procedures with low surgical invasiveness, the review and assessment of medical records may be done on or before the day of surgery by anesthesia staff.

The information obtained may include, but should not be limited to,

a) A description of current diagnoses
b) Treatments, including medications and alternative therapies used;
c) Determination of the patient’s medical condition(s);
d) Determination of birth history for pediatric patients (especially neonates)

The timing of such assessments may not be practical with the current limitation of resources provided in specific healthcare systems or practice environments. An initial record review, patient interview, and physical examination should be performed before the day of surgery for patients with high severity of disease. For patients with low severity of disease and undergoing procedures with high surgical invasiveness, the interview and physical exam should also be performed before the day of surgery.

For patients with low severity of disease undergoing procedures with medium or low surgical invasiveness, the initial interview and physical exam may be performed on or before the day of surgery.

*Selection and Timing of Preoperative Tests Routine*

Preoperative tests should not be ordered routinely. Preoperative tests may be ordered, required, or performed on a selective basis for purposes of guiding or optimizing perioperative management. The indications for such testing should be documented and based on information obtained from medical records, patient interview, physical examination, and type and invasiveness of the planned procedure.
**Preoperative Testing in the Presence of Specific Clinical Characteristics**

There is insufficient evidence to identify explicit decision parameters or rules for ordering preoperative tests on the basis of specific clinical characteristics. Consideration of selected clinical characteristics may assist the anesthesiologist when deciding to order, require, or perform preoperative tests.

**Informed consent**

Consent will be required for procedures such as nerve blocks or regional techniques. This will detail the risks discussed, whether common or uncommon, serious or minor.

Parental consent will also be sought where the anaesthetic plan includes the use of suppositories.

An appropriate post-operative plan will be formulated at the pre-op visit and explained to the patient. This may include the use of PCAs, admission to ICU/HDU, invasive blood pressure monitoring, etc.

Pre-anesthesia preparation: This preparation is done for outpatients. The preparations made are as follows:

**Psychological preparation:**

a) Give an explanation to the patient and or his family in order to understand the anesthesia and surgery plan so that the patient and family are expected to be calm.

b) Form of an explanation to the patient and or his family, administration of sedative drugs to the patient if excessive anxiety / uncooperative patient

**Physical preparation:**

a) Stop habits such as smoking, drinking, and certain drugs at least 2 weeks before anesthesia or at least starting from the first evaluation at the clinic

b) Take off the prosthesis or accessories and don’t use cosmetics

c) Following the fasting guidelines (Table 12)

d) It is required that the patient invites the family / relatives to accompany / wait during the surgery process and when returning home to anticipate the possibility of unwanted complications

e) Make a letter of approval of medical action

f) Stop smoking, drinking, and certain drugs
g) Remove the prosthesis or accessories, do not use cosmetics
h) Other preparations that are specifically pre-anesthesia. If deemed necessary, corrections can be made to systemic abnormalities encountered during the evaluation of preoperative procedures such as transfusion, dialysis, and others according to the management of each patient suffered

Table 12: Fasting guidelines

<table>
<thead>
<tr>
<th>Ingested material</th>
<th>Min</th>
<th>Minimum fasting period (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear liquids: Water, fruit juice without pulp, carbonated beverages, clear tea, black tea</td>
<td>2 2</td>
<td>2</td>
</tr>
<tr>
<td>Human milk</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Non-human milk including Infant formula</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>L Light meal: light meal typically consists of toast and liquids.</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Regular or heavy meal that include fried or fat foods or meat</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Pre-anesthesia checklist

*Preparation in the central surgical installation preparation room
- Re-evaluate the patient’s current status and patient’s medical records and other equipment
- Consultation on the spot if needed
- Change clothes with special clothes operating room
- Provision of premedication
- Other actions such as infusion

*Preparation in the operating room
- Operating tables and instruments required
- Anesthesia machine and gas flow system
- Resuscitation devices and resuscitation drugs
● Anesthetic medicines needed
● Blood pressure monitoring devices, body temperature, ECG, pulse oximeter
● Anesthesia medical record card
● Special warm blankets for babies and parents.
● Preparation of complications that will occur.

*Surgical Safety Checklist
The Checklist is intended as a tool for use by clinicians interested in improving the safety of their operations and reducing unnecessary surgical deaths and complications. Its use has been demonstrably associated with significant reductions in complication and death rates in diverse hospitals and settings, and with improvements in compliance to basic standards of care.

**Guidelines on surgical safety checklist
1. In order to implement the Checklist during surgery, a single person must be made responsible for performing the safety checks on the list. This designated Checklist coordinator will often be a circulating nurse, but it can be any clinician participating in the operation;
2. In each phase, the Checklist coordinator must be permitted to confirm that the team has completed its tasks before it proceeds onward;
3. Each team should seek to incorporate use of the Checklist into its work with maximum efficiency and minimum disruption while aiming to accomplish the steps effectively.
4. All steps should be checked verbally with the appropriate team member to ensure that the key actions have been performed;
5. Before induction of anaesthesia, the person coordinating the Checklist will verbally review with the anaesthetist and patient (when possible) that patient identity has been confirmed, that the procedure and site are correct and that consent for surgery has been given;
6. The coordinator will visualize and verbally confirm that the operative site has been marked (if appropriate) and will review with the anesthetist the patient’s risk of blood loss, airway difficulty and allergic reaction and whether an anaesthesia machine and medication safety check has been completed;
7. Before skin incision, each team member will introduce him or herself by name and role. If already partway through the operative day together, the team can simply confirm that everyone in the room is known to each other.

8. The team will confirm out loud that they are performing the correct operation on the correct patient and site and then verbally review with one another, in turn, the critical elements of their plans for the operation, using the Checklist for guidance;

9. Confirm that prophylactic antibiotics have been administered within the previous 60 minutes and that essential imaging is displayed, as appropriate;

10. Before leaving the operating room, the team will review the operation that was performed, completion of sponge and instrument counts and the labeling of any surgical specimens obtained.

▶ Summary and conclusions on pre-anesthetic evaluation

Content of the pre-anesthetic evaluation includes, but is not limited to,
1) Readily accessible medical records,
2) Patient interview,
3) A directed pre-anesthesia examination,
4) Preoperative tests when indicated, and
5) Other consultations when appropriate.

At a minimum, a directed pre-anesthetic physical examination should include an assessment of the airway, lungs, and heart. Timing of the pre-anesthetic evaluation can be guided by considering combinations of surgical invasiveness and severity of disease.

Limitations in resources available to a specific healthcare system or practice environment may affect the timing of the pre-anesthetic evaluation. The healthcare system is obligated to provide pertinent information to the anesthesiologist for the appropriate assessment of the invasiveness of the proposed surgical procedure and the severity of the patient’s medical condition well in advance of the anticipated day of procedure for all elective patients.
Decision-making parameters for specific preoperative tests or for the timing of preoperative tests cannot be unequivocally determined from the preoperative assessment. Specific tests and their timing should be individualized and based upon information obtained from sources such as the patient’s medical record, patient interview, physical examination, and the type and invasiveness of the planned procedure.

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PRACTICE OF ANESTHESIA

Introduction
Anaesthetic experience in the undergraduate timetable is often very limited so it can remain somewhat of a mysterious practice well into specialist training. This introduction to the components of an anaesthetic will help readers to get more from clinical attachments in surgery and anaesthetics or serve as an introduction to the topic for novice or non-anaesthetists.

Types and sites of anaesthesia
The term anaesthesia comes from the Greek meaning loss of sensation. Anaesthetic practice has evolved from a need for pain relief and altered consciousness to allow surgery. Early anaesthetics used plant derivatives with later introduction of ether, inhaled gases and chloroform. Modern anaesthesia has been developed and refined to enable surgery, interventions, pain relief and stabilization, and organ support.

Various forms of anaesthesia are conducted throughout the hospital and beyond. The operating theatres are the most common venue but anaesthetics are delivered on the labor ward, day surgery, intensive care, the emergency room, interventional radiology, computed tomography and magnetic resonance imaging, and on the wards during emergency care and transfer of acutely unwell patients. Certain regional procedures may take place in pain clinics and outpatient settings.

**In general anaesthesia** a reversible state of unconsciousness is achieved. It can be divided into three stages: induction, maintenance and emergence. **In regional anaesthesia**, nerve transmission is blocked, and the patient may stay awake or be sedated or anaesthetized during a procedure. Techniques used include:
Components of a general anaesthetic

A general anaesthetic always involves a hypnotic agent, usually an analgesic and may also include muscle relaxation. The combination is referred to as the ‘triad of anaesthesia’. The relative importance of each component depends on surgical and patient factors: the intervention planned, site, surgical access requirement and the degree of pain or stimulation anticipated. The technique is tailored to the individual situation.

Induction of Anesthesia

The induction of anaesthesia refers to the transition from an awake to an anaesthetized state. This end point can be ill defined and the process of induction is a time of physiological disruption with multi-system effects.

**Standard induction**

**Intravenous**

- The standard induction is with the intravenous agent propofol. A calculated by weight dose is delivered and the effects reviewed before further titration of the drug. Delays in inducing anaesthesia may represent slow arm–brain circulation time (e.g. elderly, cardiovascular disease), patient anxiety, recreational drug use or extravasation. Beside propofol, Ketamine, thiopentone and Midazolam are also used in many conditions.
- An opioid is often given to reduce the dose of induction agent needed and smooth the induction process. Morphine, Fentanyl are the most used in LMICs
- A muscle relaxant is usually given if intubation is required. Suxamethonium, Vecuronium, rocuronium and other are often used.

**Inhalational induction**

An alternative method of inducing anaesthesia is with a volatile agent, e.g. sevoflurane. The concentration of volatile delivered is gradually increased with the patient spontaneously breathing. Common uses include paediatric
practice, cases of difficult airway, difficult venous access or inhaled foreign body where maintaining spontaneous ventilation is preferable. Intubation of the trachea can be achieved under deep inhalational induction without muscle relaxation.

**Rapid sequence induction**

**When and Why?**

A specifically adapted induction process is used when rapid intubation of the trachea is required to minimize risk of regurgitation and aspiration. Such instances include intestinal obstruction or in abdominal pathology, an un-fasted patient in an emergency or trauma situation, obstetric emergency or a strong history of reflux. Pre-oxygenation plus rapid induction and paralysis obviate the need for bag mask ventilation before securing the airway, so the risk of gastric insufflation and regurgitation is reduced (Sinclair and Luxton, 2005).

**Table summarizing the Rapid sequence induction**

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Trained staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emergency drugs and equipment</td>
</tr>
<tr>
<td></td>
<td>Tipping trolley</td>
</tr>
<tr>
<td></td>
<td>Suction on under pillow</td>
</tr>
<tr>
<td></td>
<td>Aspiration of nasogastric tube</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-oxygenation</th>
<th>Fraction of inspired oxygen 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3minutes regular breathing or five vital capacity breaths</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cricoid pressure</th>
<th>Pressure over cricoid cartilage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compression of underlying oesophagus</td>
</tr>
<tr>
<td></td>
<td>Prevents regurgitation of gastric contents soiling oropharynx or airway</td>
</tr>
<tr>
<td></td>
<td>Release pressure if vomiting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drugs</th>
<th>No co-induction opioid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thiopentone 3–5mg/kg</td>
</tr>
<tr>
<td></td>
<td>Suxamethonium 1–2mg/kg</td>
</tr>
</tbody>
</table>
Once tracheal intubation confirmed:

- Ventilation commenced
- Cricoid pressure released

**Muscle relaxation**

If intubation is required, it may be necessary to paralyse the patient using:

- Depolarizing muscle relaxants (e.g. suxamethonium)
- Non-depolarizing muscle relaxants (benzylisoquinolones, e.g. atracurium, cisatracurium or aminosteroids, e.g. rocuronium).
- Normally, an action potential reaching the nerve terminal of the neuromuscular junction causes calcium influx and acetylcholine to be released pre-synaptically. Acetylcholine crosses the cleft and binds to postsynaptic nicotinic acetylcholine receptors causing opening of these ion channels and depolarization of the motor end plate. If a sufficient end plate potential is achieved, an action potential is generated leading to muscle contraction (King and Hunter, 2002).
- A depolarizing agent such as suxamethonium (biochemically two acetylcholine molecules) binds to the postsynaptic acetylcholine receptors, resulting in transient receptor agonism and muscle contraction followed by a refractory period of muscle relaxation within 30–60 seconds lasting several minutes. Its relatively short-lived effects are the result of its metabolism by plasma cholinesterase.
- Non-depolarizing agents are competitive antagonists of acetylcholine at the postsynaptic nicotinic receptor and are used for more prolonged paralysis. Blocking the ion channel, their main action is to prevent end plate depolarization and propagation of the impulse. Atracurium undergoes spontaneous degradation in the plasma known as ‘Hoffman’ degradation, while some is hydrolysed by esters so it is a useful agent in patients with hepatic and renal impairment as offset is not reliant on organ function. As the percentage acetylcholine receptor occupancy falls, competitive antagonism is lost and acetylcholine can once again bind to receptors to generate an end plate potential and reach the threshold for transmission. Neuromuscular function is restored (Appiah-Ankam and Hunter, 2004).
• Neuromuscular junction function should be monitored using a peripheral nerve stimulator and observing response to stimulations over a peripheral nerve (e.g. ulnar). The stimulation is supramaximal in order to stimulate all the nerve fibres and produce a consistent muscular response. The number and strength of resultant muscle twitches gives information about the recovery of the neuromuscular junction (Davis and Kenny, 2003). In order to enhance neuromuscular recovery post nondepolarizing relaxation at the end of surgery, the amount of acetylcholine in the synapse is increased by inhibiting the acetylcholinesterase enzyme using a reversal agent such as neostigmine.

Airway maintenance
Under anaesthesia the soft tissues of the airway relax and patency may be lost. Protective airway reflexes are also suppressed. Manual manoeuvres and simple adjuncts such as a chin tilt, jaw thrust and Guedel airway are used as soon as the patient begins to lose airway tone to prevent obstruction. Conventionally the options for maintaining the airway of an anaesthetized patient are a supraglottic device (e.g. laryngeal mask airway) or endotracheal intubation. At the preoperative visit, history, examination and review of investigations and previous anaesthetic charts contribute to the assessment of the airway and perioperative planning (Cranshaw and Cook, 2011).

Maintenance of Anesthesia
Maintenance of anaesthesia refers to keeping a patient unconscious and can be achieved using inhaled volatile agents or continuous infusion of intravenous agents.

Volatile agents are most commonly used, delivered via vaporisers found on the ‘back bar’ of the anaesthetic machine which feed into the breathing circuit. The concentrations of the inhaled agents are measured and displayed. Expired end tidal concentration is equivalent to the alveolar concentration which in turn represents the concentration at the site of action (CNS). This gives the anesthetist an idea of the amount of anaesthetic agent reaching the patient and the likely depth of anaesthesia. The minimal alveolar concentration is the alveolar concentration of a volatile agent which when given alone prevents movement in 50% of healthy
volunteers to a standard surgical stimulus (e.g. skin incision). The minimal alveolar concentration varies between different volatile agents inversely related to their potency (as their structures vary) and is also affected by other pharmacological and physiological variables (Yentis et al, 2009).

Intravenous maintenance of anaesthesia can be achieved with infusions of propofol with or without an opioid delivered via a pump. Several pharmacokinetic models have been developed which map the theoretical body compartments among which a drug distributes. The desired plasma or effector site concentration can be dialed up alongside basic patient demographics (age, sex, weight) and the pump adjusts the rate of infusion to achieve the specified drug concentration. This is known as a target-controlled infusion. Effective secure intravenous access is crucial. The choice of maintenance technique may be determined by surgical and patient factors and the experience of the anesthetist. Total intravenous anaesthesia is often used in day surgery, neurosurgery or if patients get severe postoperative nausea and vomiting as it avoids emetogenic volatiles and enables rapid recovery with minimal hangover effect (Yuill and Simpson, 2002).

**Systemic effects of general anaesthesia**

General anaesthesia leads to multi-system physiological changes (See table below). The systemic effects of anaesthesia vary with the drugs used so different agents are favored in different clinical contexts. In general, intravenous (propofol and thiopentone) and volatile agents all reduce blood pressure as a result of vasodilation, and negative inotropy and chronotropy. Starting positive pressure ventilation (i.e. ventilating someone) can impede venous return to the heart, reducing preload and cardiac output. The sympathetic stimulation from surgery opposes these changes.
Table showing the Systemic effects of general anaesthesia

<table>
<thead>
<tr>
<th>System</th>
<th>Common anaesthetic agents</th>
<th>Ketamine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td><strong>Hypotension</strong>: mean arterial pressure = (heart rate  x stroke volume)  x systemic vascular resistance</td>
<td>Normotension or hypertension</td>
</tr>
<tr>
<td></td>
<td>Vasodilation (↓systemic vascular resistance)</td>
<td>Tachycardia</td>
</tr>
<tr>
<td></td>
<td>Negative chronotropy (↓heart rate)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negative inotropy (↓stroke volume)</td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>Loss of airway reflexes and tone</td>
<td>Airway reflexes and tone maintained</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bronchodilation</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Propofol = antiemetic</td>
<td>Salivation</td>
</tr>
<tr>
<td></td>
<td>Volatiles = emetogenic</td>
<td>Emetogenic</td>
</tr>
<tr>
<td>CNS</td>
<td>Hypnosis</td>
<td>Dissociative anaesthesia, analgesia, hallucinations</td>
</tr>
</tbody>
</table>

From Sasada and Smith (2008)

Intravenous (propofol, thiopentone...) and volatile agents are all respiratory depressants and depress airway reflexes to differing degrees.

**Propofol** is particularly effective at inducing transient apnoea and depress airway reflexes facilitating placement of supraglottic devices post induction. Of the volatile agents, sevoflurane is the least irritant to airways making it particularly suitable for gaseous induction and paediatrics. Both sevoflurane and isoflurane are bronchodilators and may even have a role in the management of brittle asthma.

**Ketamine** is an exceptional intravenous agent in that it maintains cardiovascular stability and preserves muscular tone, airway patency and bronchodilates in addition to its analgesic properties. It is termed a ‘dissociative anaesthetic’, meaning the patient may be unaware and detached from his/her surroundings but not completely unconscious. Its attributes make it useful in haemodynamically unstable patients, the developing world and field anaesthesia (Peck et al, 2008).
Table showing stages of a general anaesthetic: an A, B, C, D approach

<table>
<thead>
<tr>
<th>Stage of general anaesthesia</th>
<th>Airway</th>
<th>Breathing</th>
<th>Circulation</th>
<th>Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction</td>
<td>Plan for securing, maintaining and protecting airway as soft tissue tone and reflexes are lost</td>
<td>High flow oxygen at induction, consider pre-oxygenation</td>
<td>Vasodilation leads to reduced systemic vascular resistance and mean arterial pressure, intubation can cause sympathetic hypertensive response</td>
<td>Intravenous: analgesia (opioid co-induction, e.g. fentanyl) then hypnotic agent (e.g. propofol, thiopentone) with or without muscle relaxation or volatile gas induction (sevoflurane)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintain airway position and Patency</td>
<td>Maintain saturations, ventilatory strategies, lung protection</td>
<td>Maintain adequate cardiac output and tissue perfusion, fluid balance.</td>
<td>Volatile (e.g. sevoflurane, isoflurane, desflurane) Intravenous (total intravenous anaesthesia, e.g propofol +/- remifentanil), analgesia, antiemesis</td>
</tr>
<tr>
<td>Emergence</td>
<td>Suction secretions, as airway tone and reflexes return plan for safe removal of supraglottic device or extubation</td>
<td>Increase fraction of inspired oxygen, ensure adequate spontaneous tidal volumes</td>
<td>Time of haemodynamic instability</td>
<td>Reversal of neuromuscular block</td>
</tr>
</tbody>
</table>

**Emergence and recovery**

Once anaesthesia is no longer required, **maintenance agents can be switched off**. Before emergence, adequate analgesia and anti-emesis should be ensured and neuromuscular junction function restored if a muscle relaxant has been used.
Like induction, emergence can be a time of physiological disturbance. As patients start to wake from anaesthesia or ‘lighten’ they may develop agitation, laryngospasm and breath-holding.

*Conventionally extubation* is performed following oropharyngeal suction, once the patient is generating good tidal volumes and is awake, ensuring airway reflexes have returned and the patient will protect his/her own airway. In certain circumstances extubation may be performed ‘deep’, i.e. with the patient still under anaesthesia. Under anaesthesia, airway reflexes will remain suppressed, reducing the risk of coughing, laryngospasm and hypertension associated with extubation. This may be preferable in certain neurosurgical and cardiac patients in whom surges in intracranial or systemic blood pressure should be avoided. However, the airway will be unprotected against aspiration until the patient is awake.

The recovery room is an intermediate place of safety between theatre and the ward where immediate surgical or anaesthetic complications can be detected and managed.

Vital signs, pain scores and other potential problems such as postoperative nausea and vomiting are monitored.

#### Perioperative care

Perioperative care should be carried on as a wholistic medicine and consider preserving physiological variables of the patient under surgery in order to enhance outcome.

---

#### Warming

As homeothermic mammals, our core temperature is designed to be around 36.5°C. Patients are susceptible to hypothermia under anaesthesia as a result of vasodilation causing redistribution of heat from core to periphery, convection, radiation (exposed areas), conduction (contact with cold metal objects), evaporation (endotracheal tube bypasses nasopharyngeal humidification, exposed moist mucosal surfaces) and loss of compensatory heat preserving or heat-generating mechanisms, e.g. shivering.

Hypothermia can cause coagulopathy, perioperative cardiac events, increased risk of postoperative infection and can prolong recovery and
hospital stay. Exposure should be minimized and temperature monitored pre-, intra- and postoperatively. Warm air devices and warmed fluids can be used to offset heat loss and maintain optimal body temperature (Harper et al, 2008).

 Fluid balance
The anaesthetist needs to be an expert in fluid resuscitation, using crystalloids, colloids and blood products where appropriate. The aim is to ensure good tissue perfusion and hence oxygenation. Rather than give a fixed fluid dose, monitors (e.g. oesophageal doppler) are often used and fluid challenges given to achieve a set endpoint, aiming to avoid hyper- or hypovolaemia (Doherty and Buggy, 2012).

 Positioning
Patients are vulnerable to nerve and pressure point injury under anaesthesia and protection of these areas is the responsibility of the anaesthetist. Patients should ideally be in a neutral position with padding used to support at-risk areas (Knight and Mahajan, 2004).

 Awareness
Awareness is the unplanned recall of events under anaesthesia and is often one of the complications patients fear most. It can be implicit or explicit, from a vague sense of having been awake through to specific memories of events and conversations respectively. Awareness is distressing and can lead to post-traumatic syndromes. Monitoring for awareness can include clinical observation (such as papillary dilatation, lacrimation, sweating) and measurement (heart rate, blood pressure, end tidal volatile concentration and depth of anaesthesia monitors). Most depth of anaesthesia monitors interpret patterns of neuronal electrical activity to deduce the level of conscious state (Al-Shaikh and Stacey, 2007).

 Other drugs
Aside from the traditional triad of anaesthesia drugs, the cardiovascular system is often manipulated to offset the effects of anaesthesia or surgical stimulation. Heart rate may be increased by an anti-muscarinic (e.g. atropine or glycopyrrolate) or a mixed beta-adrenoceptor agonist (e.g. ephedrine) or reduced by beta-blockers. Blood pressure can be
increased by vasoconstricting with an alpha 1 adrenoceptor agonist such as metaraminol or reduced with an alpha antagonist (e.g. phentolamine).

**Analgesia**

Pain relief is very important for patients and features in the triad of anaesthesia. Despite a patient being unconscious and unaware intraoperatively, stimulation (e.g. surgery) will still elicit a sympathetic response which analgesia can desirably attenuate. Appropriate analgesia is also essential for smooth emergence and comfort immediately after surgery. Analgesia is typically multi-modal with opioids titrated to extent of stimulation and predicted postoperative pain.

**Safety**

Patient safety is crucially important. The World Health Organization surgical safety checklist is a tool to attempt to make the perioperative journey safer and enhance team communication. The entire team must ensure the correct patient is consented for the correct procedure and that any allergies or potential complications are acknowledged and shared among the team. The World Health Organization surgical safety checklist has three components which are completed on arrival to the anesthetic room, before the start of surgery or intervention and at the end of the procedure (Walker et al, 2012).

**Management of perioperative emergencies**

These drugs are used mainly in case of life-threatening conditions that may occur during pre-anesthesia, intraoperative and postoperative period or in any case resuscitation is required. Team work is key to successful resuscitation.

*Hypotension*

Hypotension is commonly encountered in anesthesia. When sustained uncorrected, hypotension may result in end-organ (eg: brain, heart and kidneys) hypoperfusion. Hypotension should be assessed to know underlying cause (hemorrhage, hypovolemia, drugs, cardiac disease). Treatment hypovolemia with bolus iv fluid 250 ml for adults and 10ml/kg for pediatric patient. Consider vasopressors like ephedrine 5-10 mg iv. Escalate with adrenaline

*Allergy reactions and anaphylaxis*

The diagnosis of anaphylaxis is clinical and should be suspected upon following sings:

- Unexplained hypotension
- Unexplained bronchospasm (*wheeze may be absent if severe*)
- Unexplained tachycardia or bradycardia
- Angioedema (*often absent in severe cases*)
- Unexpected cardiac arrest where other causes are excluded
- Cutaneous flushing in association with one of more of the signs above (*often absent in severe cases*).

**Management**: call for help and stop possible cause.

- Administer oxygen O2 100% and secure airways
- For hypotension: give adrenaline 50mcg iv or 0.5mg im (adults) and 1mcg/kg(pediatric).
- Other drugs: hydrocortisone
  - Adult: 200 mg
  - Child 6-12 years: 100 mg
  - Child 6 months-6 years: 50 mg
  - Child <6 months: 25 mg

*Local anesthesia toxicity*

Local anesthesia is being used by different clinicians. Clinical presentations of local anesthesia toxicity (LAST) may vary and should be suspected when physiological changes occur immediately after use. Sudden alteration in mental status, severe agitation or loss of consciousness, with or without tonic-clonic convulsions. Cardiovascular collapse: sinus bradycardia, conduction blocks, asystole and ventricular tachyarrhythmias may all occur.

Stop injection and call for help. Administer anti-seizures like midazolam 1-2mg iv or diazepam 0.3mg/kg iv if patient presents convulsions.

For cardiac arrest: Call for help and start chest compression and initiate infusion of lipid emulsion (*Intralipid 1.5ml/kg iv then 0.25ml/kg/min*)
Malignant hyperthermia is a life-threatening condition during anesthesia characterized with acute rise of end-tidal CO2 associated with tachycardia and rise of body temperature as late sign. Treatment consists of stopping possible causes (succinylcholine or inhalational anesthetic) and initiate intravenous hypnotics. Start Dantrolene 2.5mg iv bolus and 1mg/kg every 10-15min as required. The maximum dose is at 10mg/kg and additional supportive care like cooling the patient and intravenous fluid as well [Pawan K.G et al., 2017).

Cardiac arrest

- Recognize sudden cardiac arrest (SCA) as soon as possible by noting unresponsiveness or absent/gasping breathing
- Initiate CPR as soon as the patient is thought to be in cardiac arrest and alert the team, or call for help
- Activate the resuscitation team within the health facility as soon as possible
- Health care providers may perform a carotid pulse check for no longer than 10 seconds prior to initiating CPR in an unresponsive patient
- Perform excellent CPR – «(push hard, push fast)» (but not too hard nor too fast) – with continuous attention to the quality of chest compressions, and to the frequency of ventilations.
  - Maintain the rate of chest compression at 100 to 120 compressions per minute
  - Compress the chest at least 5 cm (2 inches) but no more than 6 cm (2.5 inches) with each down-stroke
  - Allow the chest to recoil completely after each down-stroke (it should be easy to pull a piece of paper from between the rescuer’s hand and the patient’s chest just before the next down-stroke)
  - Minimize the frequency and duration of any interruptions
- Give two ventilations after every 30 compressions, discontinuing compressions during the ventilations for patients without an advanced
TREATMENT GUIDELINES

airway
- Provide only enough tidal volume to observe the chest rise (approximately 500 to 600 mL, or 6 to 7 mL/kg)
- Start adrenaline boluses 1mg/ml every 3-5 minutes during CPR and flash it with water for injection drawn at every adrenaline bolus to give.
- Use an automated external defibrillator as soon as one is available.
- Define shockable rhythms and readjust the management accordingly
- Administer amiodarone (300 mg IV/IO bolus with a repeat dose of 150 mg IV as indicated) or lidocaine (1 to 1.5 mg/kg IV/IO bolus, then 0.5 to 0.75 mg/kg every 5 to 10 minutes) in Ventricular Fibrillation (VT) or paroxysmal VT unresponsive to defibrillation, CPR, and adrenaline.
- Administer magnesium sulfate (2 g IV/IO bolus, followed by a maintenance infusion) to treat polymorphic ventricular tachycardia consistent with torsade de pointes, but is not recommended for routine use in adult cardiac arrest patients

Administer atropine 0.5-1mg boluses to treat high-vagal tone (eg, inferior myocardial ischemia due to ACS), medication-induced (supratherapeutic levels of beta-blockers, calcium channel blockers, digitalis) and high-degree AV block with a narrow QRS complex (thought to emanate at or above the AV node) (https://www.uptodate.com/contents/advanced-cardiac-life-support-acls-in-adults?search=ADVANCED%20CARDIAC%20ARREST%20&source=search_result&selectedTitle=7~150&usage_type=default&display_rank=7, accessed on 3rd September, 2021).

*Hypertensive crisis
Hypertension is mostly due to inadequate depth anesthesia or inadequate analgesia. Check the underlying causes and treat if hypertension persists though adequate depth of anesthesia and analgesia. Initiate temporizing drugs like hydralazine 0.1mg/kg iv (5-10mg iv for adults), glyceryl trinitrate 0.5-5mcg/kg/min infusion.

*Conclusions
Anaesthesia is an enormous subject and this article is merely a tip of the iceberg introduction to some types of regional and general anaesthesia. Anaesthetists, while developing specialized airway skills and a deep
understanding of physiology and pharmacology, need an holistic approach and broad knowledge base because of the varied nature of their role. Anaesthetists will come into contact with approximately two thirds of hospital patients in a diverse range of clinical contexts and environments. Hopefully this article has whetted your appetite to know more or given you a fresh insight into a specialty which is taking place in all corners of your hospital.

CRISIS MANAGEMENT

All anesthesia providers should be equipped to manage life-threatening crises which may arise with little or no warning. During daily activities, an anesthesia provider may spend much of his work, preventing and heading off potential crises.

An anesthesiologist has to manage these complex problems promptly and efficiently with skilled ways of recognition and frequently practiced clinical routines.

*Guidelines on crisis management

- Every anesthetist has to be trained on BLS and/or ACLS so that he/she can handle all the life-threatening problems before, during and after anesthesia
- Crisis management should be mainly at an anesthesia provider awareness in every facility in which he/she works
- Cognitive aids should be available all over the perioperative areas of the health facility, emergence department, obstetric and gynecological settings, neonatal, pediatric and adults intensive care units.
- Structured algorithms should be hung all over the areas with anesthesia provision
○ Rehearsal of crisis management among the staff should be done regularly
○ Every anesthesiologist has to train the rest of the hospital staff about anesthesia crisis management as part of the accreditation requirements
○ Regular checks and refilling of emergence trolleys into every wards and departments into the hospital should be undertaken and responsibly reported to resuscitation team leader

*Record keeping*
A full record of the anesthetic given to the patient either written or electronic should be documented and kept including the details of: The date of surgery (either done or canceled and the reasons of canceling), the pre-operative anesthesia, the type of anesthesia provided, the duration of surgery, intra-operative management and post-operative anesthesia with specific complications and how they were managed and its outcome on the patient.
POSTANESTHESIA CARE

Structure of post-anesthesia care unity

- It should be located close to the operating suite to permit anesthesiologists and surgeons to be nearby and allow rapid return of the patient to the operating room if necessary. It is also useful to have the recovery room located near to the ICU.

- The size of the recovery room is determined by the surgical caseload of the institution. The number of bed/trolley spaces must be sufficient for expected peak loads and there should be not less than 1.5 bed spaces per operating room. The space allocated per bed/trolley should be 9 to 12 square meters with easy access to the head of the patient.

- It should have large doors, adequate lighting, and sufficient electrical socket points and water point /sink.

- There should be a central nursing station as well as space for storage of equipment and drugs room. An open ward is optimal for patient observation; however, at least one isolation room is a helpful addition to every PACU for the management of patients with either contaminated wounds or severe immunosuppressant.

Equipment and supply in post-anesthesia care unity

- Each bed space must be provided with a monitor (NIBP, ECG, SPO2, temperature), an oxygen source, two general power outlets, and adequate lighting.

- There should be a wall clock with a sweep second hand or digital equivalent clearly visible from each bed space.

- Communication facilities- An emergency call system and a telephone.
Within the recovery room there must be stethoscope, suction machine a range of devices for the administration of oxygen to spontaneously breathing patients.

A self-inflating manual resuscitator e.g. Ambu bag in order to deliver an oxygen enriched mixture for inflating the lungs.

Equipment and drugs for airway management and endotracheal intubation as well as various sized oral and nasopharyngeal airways must be present.

A well-stocked emergency difficult airway trolley in recovery is useful.

Emergency drugs, a range of intravenous equipment and fluids and drugs for acute pain management should be on hand. Syringes and needles of varying sizes must also be stocked.

Patient warming devices.

There should be immediate access to a monitoring defibrillator preferably with pacing facility, a refrigerator for drugs and blood and a procedure light.

A surgical tray for procedures including tracheostomy and chest drains as well as point of care access to diagnostic services e.g. blood glucose, blood gas and portable XRAY.

The recovery trolley/bed must have a firm base and mattress and must tilt from either end - both head up and head down - to at least 15 degrees and is easy to maneuver with functional and accessible brakes. It must also provide for sitting the patient up and have straps or side-rails which must be able to be dropped below the base or be easily removed. The trolley/bed must also have a pole from which intravenous solutions may be suspended.

--- | Staffing in post-anesthesia care unity

It is the responsibility of the institution to ensure that the staff appointed to the recovery room is trained and competent. The recovery staff must be available at all times.
A nurse trained and competent in recovery room care must be present at all times. An appropriately trained registered nurse experienced and competent recovery room work should be in charge.

Post anesthesia care unit should be under responsibility of Anesthesia provider.

--- Monitoring in post-anesthesia care unity

The patient shall be observed and monitored by methods appropriate to the patient’s medical condition. Particular attention should be given to monitoring oxygenation, ventilation, circulation and temperature.

Observations should be recorded at appropriate intervals and should include at least, state of consciousness, color, respiratory rate, oxygen saturation, pulse and blood pressure and level of pain.

The record should form part of the patient’s clinical notes. All patients should remain until the anesthesia provider considers it safe to discharge them from the recovery room, according to validated criteria, which includes the return of protective airway reflexes, stable cardiovascular and respiratory function, full reversal of neuromuscular blockade, absence of nausea and vomiting and absence of pain. Use of an appropriate PACU scoring system is encouraged for each patient on admission, at appropriate intervals prior to discharge and at the time of discharge.

The anaesthesia care provider is responsible for accompanying the patient to the recovery room and adequately handing him/her over to the nursing staff who will document the patient’s condition on arrival and subsequent course in recovery.

The anaesthesia care provider/member of the Anaesthesia Care Team shall remain in the PACU until the PACU nurse accepts responsibility for the nursing care of the patient, or delegates this responsibility to another anesthesia provider or trained medical officer who will supervise the recovery period and authorize the patient’s discharge.

When discharge criteria are used, they must be approved by the Department of Anesthesia and the medical staff. They may vary depending on whether
the patient is discharged to a hospital room, to the ICU, to a short stay ward or home. In the absence of a medical staff, the PACU nurse shall determine that the patient meets the discharge criteria. The name of the medical staff accepting responsibility for discharge shall be noted on the record.

--- | Post-anesthesia care unity orders
The anesthesia providers should give orders to the PACU nursing team. This will guide the management of the patient during the PACU stay. The table below provides a summary of the common orders.
POST ANESTHESIA CARE UNIT (PACU) ANESTHESIA ORDERS

Patient names:

Allergy:

Bradycardia/Hypotension
- Atropine 0.5 mg IV prn x 1 dose for HR < 40 bpm with systolic BP < 80 mmHg
- Ephedrine 10 mg IV q5min prn for systolic SBP < 80 mmHg
- Contact anesthesia provider immediately if either atropine or ephedrine are used

Analgesia
- Morphine  mg IV q  min prn. Maximum dose  mg.
- Meperidine  mg IV q  min prn. Maximum dose  mg.
- Fentanyl  mcg IV q  min prn. Maximum dose  mg.
- Paracetamol  mg po/prn x 1 dose
- Diclofenac  mg IM q  min prn. Maximum dose  mg.
- Tramadol  mg IV q  min prn. Maximum dose  mg.
- Other please specify

Nausea
- Ondansetron  mg IV q  min prn. Maximum dose  mg.
- Metoclopramide  mg IV q  min prn. Max dose  mg.
- Dexamethasone  mg IV q  min prn. Maximum dose  mg.
- Other please specify

Sedation
- Midazolam 0.5-1mg IV q  min prn. Maximum dose  mg.
- Diazepam 5-10 mg IV q  min prn. Maximum dose  mg.
- Ketamine 25-50 mg IV q  min prn. Maximum dose  mg.
- Other please specify

Monitoring and treatment for respiratory depression (RASS score (somnolence score) and RR every 15 min)

Non-life-threatening respiratory depression (RASS score 1 or 2, RR<8):
Call anesthesia provider and have naloxone 0.4 mg ready at bedside
Life-threatening respiratory depression (RASS score 3 or 4, RR<8, requires vigorous effort to arouse or unresponsive): Give naloxone 0.4 mg IV, Call anesthesia provider, repeat naloxone 0.4 mg IV q 2min until at least RASS score 1 or 2 and RR > 10.

**Itching**
- Polaramine 2-4 mg oral q4prn min prn. Maximum dose mg.
- Other please specify

**Discharge:** Aldrete score of at least 9

________________________    ___________  ___________________________

Date dd /mm/yyyy    Time    Prescriber’s name
Prescriber’s signature

--- | **Transfer of care and delegation of care**

When it arrives to transfer the patient to another anesthesia provider or any health facility, the primary anesthesia provider must document all information regarding the patient with a detailed medical history, anesthesia management and complications if any and how they were managed.

If the patient is critically ill must be accompanied by a trained nurse and anesthesia provider in the ambulance with essential monitors on the patient.
PAIN MANAGEMENT

Definition of Acute Perioperative Pain

Acute pain in the perioperative setting is defined as pain that is present in a surgical patient because of preexisting disease, the surgical procedure (with associated drains, chest or nasogastric tubes, or complications), or a combination of disease-related and procedure-related sources.

Purpose of the Guidelines

The purpose of these Guidelines is to:
1. Facilitate the safety and effectiveness of acute pain management in the perioperative setting;
2. Reduce the risk of adverse outcomes;
3. Maintain the patient’s functional abilities, as well as physical and psychological well-being; and
4. Enhance the quality of life for patients with acute pain during the perioperative period.

Notice:
Adverse outcomes that may result from the undertreatment of perioperative pain include:
- Thromboembolic and pulmonary complications,
- Additional time spent in an intensive care unit or hospital,
- Hospital readmission for further pain management,
- Impairment of health-related quality of life, and
- Development of chronic pain.

Also, pain medication side effects include:
- Respiratory depression,
- Brain or other neurologic injury,
- Sedation,
- Circulatory depression, nausea, vomiting, pruritus, urinary retention, impairment of bowel function, and sleep disruption.
**Focus**

- These Guidelines focus on acute pain management in the perioperative setting for adult (including geriatric) and pediatric patients undergoing either inpatient or outpatient surgery.
- Modalities for perioperative pain management addressed in these Guidelines require a higher level of professional expertise and organizational structure than “as needed” intramuscular or intravenous injections of opioid analgesics.
- Patients with severe or concurrent medical illness such as sickle cell crisis, pancreatitis, or acute pain related to cancer or cancer treatment may also benefit from aggressive pain control.
- Labor pain is another condition of interest to anesthesia providers. However, the complex interactions of concurrent medical therapies and physiologic alterations make it impractical to address pain management for these populations within the context of this document.
- While patients undergoing painful procedures may benefit from the appropriate use of anxiolytics and sedatives in combination with analgesics and local anesthetics when indicated, these Guidelines do not specifically address the use of anxiolysis or sedation during such procedures.

**Application**

These Guidelines are intended for use by anesthesia providers and other healthcare professionals who deliver care under the supervision of anesthesiologists. The Guidelines may also serve as a resource for other physicians and healthcare professionals who manage perioperative pain. In addition, these Guidelines are intended for use by policymakers to promote effective and patient-centered care. Anesthesia providers bring an exceptional level of interest and expertise to the area of perioperative pain management. Anesthesiologists are uniquely qualified and positioned to provide leadership in integrating pain management within perioperative care. In this leadership role, anesthesiologists improve quality of care by developing and directing institution-wide, interdisciplinary perioperative analgesia programs.
Table 13: Organization and procedure for pain management

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<td>Leadership</td>
<td>• Anesthesiologist&lt;br&gt;• NPA (Non-Physician Anesthetist with Training on Pain)</td>
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<td>• Anesthesiologist with Pain management expertise/training</td>
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<tr>
<td>Procedures</td>
<td>• Pain medications&lt;br&gt;• Block if Anesthesiologist available&lt;br&gt;• Non-pharmacological approach&lt;br&gt;• Apply Multimodal analgesia approach&lt;br&gt;• Education and training</td>
<td>• Pain medications&lt;br&gt;• Blocks (single short)&lt;br&gt;• Non-pharmacological approach&lt;br&gt;• Apply Multimodal analgesia approach&lt;br&gt;• Education and training</td>
<td>• Pain medications&lt;br&gt;• Epidurals, peripheral nerve blocks single short and continuous, PCAs,&lt;br&gt;• Non-pharmacological approach (ice, heat compression, distraction, Physiotherapy,&lt;br&gt;• Apply Multimodal analgesia approach&lt;br&gt;• Education and training</td>
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Preoperative Evaluation of the Patient

A directed pain history, a directed physical examination, and a pain control plan should be included in the anesthetic preoperative evaluation. Preoperative patient evaluation and planning is integral to perioperative pain management.

Proactive individualized planning is an anticipatory strategy for postoperative analgesia that integrates pain management into the perioperative care of patients. Patient factors to consider in formulating a plan include type of surgery, expected severity of postoperative pain, underlying medical conditions (e.g., presence of respiratory or cardiac disease, allergies), the risk-benefit ratio for the available techniques, and a patient’s preferences or previous experience with pain. Although
the literature is silent regarding the value of a preoperative directed pain history, a directed physical examination, or consultations with other healthcare providers, the Task Force points out the obvious value of these activities.

---

**Preoperative Preparation of the Patient**

Patient preparation for perioperative pain management should include appropriate adjustments or continuation of medications to avert an abstinence syndrome, treatment of preexistent pain, or preoperative initiation of therapy for postoperative pain management. Anesthesiologists offering perioperative analgesia services should provide, in collaboration with others as appropriate, patient and family education regarding their important roles in achieving comfort, reporting pain, and in proper use of the recommended analgesic methods.

Common misconceptions that overestimate the risk of adverse effects and addiction should be dispelled. Patient education for optimal use of PCA and other sophisticated methods, such as patient-controlled epidural analgesia (PCEA), might include discussion of these analgesic methods at the time of the preanesthetic evaluation, brochures, and videotapes to educate patients about therapeutic options, and discussion at the bedside during postoperative visits.

Such education may also include instruction in behavioral modalities for control of pain and anxiety.

Certain groups of patients require additional attention
- Children
- Pregnant patients
- Elderly patients
- Patients with sleep apnoea
- Patients with liver or kidney disease
- Patients with cognitive, behavioral or sensory impairment
- Patients with substance use disorders (including alcohol and tobacco)
- Patients who are opioid tolerant.
References


Quality and Safety. (http://www.qshc.com/cgi/content/full/14/3/e16). doi: 10.1136/qshc.2002.004358


## APPENDICES

### List of contributors on standards of safe practice of anesthesia in Rwanda

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## Anesthesia and Pain management

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