MINISTRY OF HEALTH

STANDARD PRACTICE GUIDELINES

ASSISTANT MEDICAL OFFICERS IN ANAESTHESIOLOGY AND INTENSIVE CARE SERVICES FOR SABAH AND SARAWAK

Anaesthesia Technologist (AT)

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CAWANGAN PERKHIDMATAN
PENOLONG PEGAWAI PERUBATAN

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FORWARD MESSAGE

DIRECTOR GENERAL OF HEALTH MALAYSIA

Ministry of Health is currently intensifying healthcare delivery as part of the Millenium Development Goals as there is a growing acknowledgement that optimal healthcare cannot be delivered by merely ensuring the coexistence of infrastructure, medical supplies and healthcare providers. Strengthening our healthcare delivery requires a deliberate focus on the quality of health services, which involves providing effective, safe, patient-centred care that is timely, equitable, integrated and efficient. There are three sub-disciplines in Anaesthesia and Intensive Care Services, which are Anaesthesia (Anaesthesia Technologist – AT), Intensive Care Unit (Intensive Care Technologist – ICT) and Peri-anaesthesia (Anaesthetic Assistant and Technologist – AAT). These Standard Practice Guidelines (SPG) are prepared for AMO working in Anaesthesia and Intensive Care Services.

The SPG aims to provide useful information for quality patient management. I hope the guidelines will be used as a primary source reference for AMO throughout the country in the execution of their duties and efforts to provide quality health care to the community. I sincerely hope this SPG endeavour in AMO in clinical practice moves to greater heights. It also enhances the quality standards management of patients by AMO in Anaesthesia and Intensive Care services.

I believe that with the adoption of this second edition, the services rendered by AMO will be enhanced to its optimum level. It also will serve as a reference to those new in the anaesthesia and intensive care services field. I am delighted as in this SPG, the role and responsibilities of AMOs are deliberately explained. In recognizing the competency of the AMOs in each subspeciality, credentialling already ongoing process started in 2018. I am confident the SPG will be well accepted. We will ensure that updates with new emerging protocols, activities and procedures will be introduced in future editions in line with current practice.

I am always impressed with efforts to strive for excellence in service delivery, and such efforts by the AMO in Anaesthesia and Intensive Care services are commendable. On behalf of the Ministry of Health, I would like to extend my distinguished congratulations to the Medical Practices Division, Assistant Medical Officers Services Section and esteemed Anaesthesiologists, as well as the AMO Technical Committee for their unwavering efforts and commitment to publishing the 2nd Edition of Standard Practice Guidelines for AMO in Anaesthesia and Intensive Care services. My personal heart-warming appreciation tributes to AMO in Anaesthesia and Intensive Care services throughout the country, who uphold a high standard of professionalism in the execution of their duties in order to provide quality health care to the community. The Ministry of Health Malaysia takes special pride in the fraternity's continuous determination for excellence in service delivery to the nation.

.....

DATUK DR MUHAMMAD RADZI BIN ABU HASSAN
Director General of Health Malaysia

FORWARD MESSAGE

DIRECTOR OF MEDICAL PRACTICE DIVISION

Throughout the years, the standard of practice among the Assistant Medical Officers in Anaesthesia and Intensive Care Services under the Ministry of Health has greatly enhanced clinical practice for better patient care management. It is noted that many years back, as there were few reference documents available, these Assistant Medical Officers needed to learn from their seniors through hands-on training with the guidance of Anaesthesiologists and Intensivists to acquire knowledge and skills in providing good quality patient care.

It is time to review the 1st edition (SOP). Hence, develop a new SPG for AMOs in Anaesthesia and Intensive Care services, as it will impact the services and performance of AMO in their clinical settings. This SPG is very essential and relevant in the current practice of AMOs in Anaesthesia and Intensive Care services with the aim of having uniformity and standardization with the consistency of practice in this discipline where the performance of AMO could be strengthened. We believe that with the adoption of this new SPG, the services rendered by AMO in Anaesthesia and Intensive Care services will be enhanced to their optimum level. It also will serve as a reference to those new to Anaesthesia and Intensive Care services.

We sincerely hope that this new version of SPG will form part of an important document to be complied with by the AMO in providing better care to patients. It is noted that preparing the new edition is not easy, as it requires good leadership, teamwork, commitment, knowledge and dedication. With that, I would like to congratulate those involved in developing this revised edition of SPG for AMO in Anaesthesia and Intensive Care services and our heartfelt appreciation to them for their passion and endless effort.

.....

DR. MOHAMED IQBAL BIN HAMZAH
Director
Medical Practice Division MOH Malaysia

FORWARD MESSAGE

HEAD OF SERVICE

The Anaesthetic and Intensive Care Service is one of the biggest services in hospitals. With increasing demands from the public and clinicians, the anaesthetic departments face many encounters in meeting these expectations. Clearly, there is a need for this critical service to be delivered in an efficient, structured and coordinated manner consistent with the vision and mission of the Ministry of Health. I believe that with this in mind, the idea of developing the Standard Practice Guidelines (SPG) by the Assistant Medical Officers Services Section was mooted. I would like to congratulate all those who have contributed by sharing their experience and knowledge during the preparation of SPG.

The first structured form of Anaesthesiology and Intensive Care Services by Assistant Medical Officer was published in 2007, which only covered the roles of Assistant Medical Officers (AMO) in Anaesthesia (East Malaysia). Currently, the new SPGs for AMO in Anaesthesia and Intensive Care services are formed as written instruction of a particular procedure which consists of scope, purpose, materials or equipment, work process, references, flow chart and revision history. It is vital for AMO in Anaesthesia and Intensive Care services to maintain quality and uniformity at all times. Therefore, it is necessary for AMO to adhere to the SPG while carrying out their duties.

I believe this revised edition of SPG for Assistant Medical Officers in the Anaesthesiology and Intensive Care services (Anaesthesia Technologist - AT) will provide a greater impact on the services and performance of AMO. This SPG is very essential and relevant in the current practice of AMO in anaesthesia and intensive care services with the aim of having uniformity and standardization with the consistency of practice in this discipline where the performance of AMO could be strengthened.

This SPG will also benefit AMO managers in formulating local hospital policies and procedures, coordinating interdepartmental collaboration, and planning for facilities and service development, ensuring that available resources are utilised optimally. This handbook is excellent as a guide to all AMO in Anaesthesia and Intensive Care service who are learning and for those already active in practice.

Overall, I hope this book will be useful for all AMO. I would like to take this opportunity to express my utmost gratitude to all of the contributors for their outstanding work, and I hope this SPG will be a useful reference for all AMO. Lastly, I would like to thank the Medical Practices Division, Assistant Medical Officers Services Section and esteemed Anaesthesiologists, as well as the AMO Technical Committee, especially the Sabah and Sarawak taskforce, for their tireless efforts and commitment to publishing the revised Edition of Standard Practice Guidelines for AMO in Anaesthesia and Intensive Care Service.

.....

DR. ZALINA BINTI ABDUL RAZAK
Head of National Anaesthesiology Services and Senior Consultant
Anaesthesiologist Head of Department,
Department of Anaesthesiology & Intensive Care Hospital Kuala Lumpur

FORWARD MESSAGE

HEAD OF ASSISTANT MEDICAL OFFICER

Despite many achievements of our healthcare delivery system in the past and present, an increasing expectancy of better services from our Assistant Medical Officer (AMO) from the public continues. Clearly, there is still much room to improve AMO services. Better approaches and processes for delivering hospital-based services ought to be articulated and implemented, and we should have the fortitude and courage to implement planned approaches.

We also need to ensure that proper structures are put in place in our acceptable hospitals, evidence-based, outcome-oriented, quality driven, practical, and above all, suit the needs and benefits of our patients in order to meet the requirement of the AMO Professional Development Plan (6P) 2016-2030 by Assistant Medical Officers Services Section. Having a well-documented SPG for AMO in Anaesthesia and Intensive Care service will help ensure that services are executed efficiently while utilising existing resources. SPG shall be among our strategies to improve the AMO services in Anaesthesia and Intensive Care, apart from measures like infrastructural and human capital development.

This SPG will achieve uniformity, standardization, correctness, accuracy and effectiveness as well consistency in performance and competency of AMO in Anaesthesia and Intensive Care service. Hence, compliance with SPG would ensure patient safety in accordance with Ministry Of Health policies and guidelines. Developing this SPG, I am sure, is a challenging task for the committee. It requires a great depth of knowledge, consistency, a team approach and the courage to decide what should constitute standard methods. I am deeply indebted to the esteemed Anaesthesiologists, Intensivists and AMO Technical Committee of Anaesthesia and Intensive Care service for their indefatigable efforts upon completing this SPG. I would like to express my gratitude to the Anaesthesia and Intensive Care fraternity for their involvement in producing this new format of SPG.

I once again congratulate the AMO Technical Committee of Anaesthesia and Intensive Care service for being the first clinical discipline to develop and publish such a comprehensive document which consists of scope, purpose, materials, equipment, work process, references, flow chart and revision history.

Warm regards,

.....

ZULHELMI BIN ABDULLAH
Head of Assistant Medical Officers
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1. The Director General of Health, Malaysia
2. The Deputy Director General of Health (Medical)
3. The Director of Medical Development Division, MOH
4. The Director of Medical Practice Division, MOH
5. The Technical Advisors of SPG
6. All Senior Consultant Anaesthesiologists, MOH
7. Head of National Anaesthesiology Services
8. The Members of the Technical Committee
9. The Panel of Reviewers
10. The Panel of Contributors
11. Assistant Medical Officer Service Section
12. All retired AMO (Anaesthesia) Sabah & Sarawak technical committee
13. All other colleagues, individuals, and organization who have contributed directly or indirectly towards the success of this publication.

TABLE OF CONTENTS

List of Abbreviations

ABG	Arterial Blood Gas
ABS	Air Breathing System
ACGO	Auxiliary Common Gas Outlet
AED	Automated External Defibrillator
ADR	Adverse Drugs Reaction
AGSS	Anaesthetic Gas Scavenging System
AAGBI	Association of Anaesthetic of Great Britain and Ireland
APL	Adjustable Pressure Limit
APS	Acute Pain Service
ASA	American Society of Anaesthesiologist
B.P.P	Basic Procedure Pack
BIS	Bispectral Index
BURP	Backwards, Upward, Rightward Pressure
BHT	Bed Head Ticket
BVM	Bag Valve Mask
cc	cubic centimetres
cm	Centimetres
cmH20	centimetre water
CNS	Central Nervous System
CO2	Carbon Dioxide
CPR	Cardiopulmonary Resuscitation
CSE	Combine Spinal Epidural
CSF	Cerebrospinal Fluid
CT	Computed Tomography
CVCI	Can't Ventilate Can't Intubate
CVP	Central Venous Pressure

List of Abbreviations

CVS	Cardiovascular System
DISS	Diameter Index Safety System
DLT	Double Lumen Tube
DVT	Deep Vein Thrombosis
ECG	Electrocardiogram
ECT	Electroconvulsive Therapy
EEG	Electroencephalogram
ERCP	Endoscopic Retrograde Cholangiopancreatography
ETCO2	End Tidal Carbon Dioxide
ETT	Endotracheal Tube
FiO2	Fraction Of Inspired Oxygen
Fr	French Scale Measurement System
G	Gauge
GA	General Anaesthesia
GSH	Glutathione
GXM	Group and Cross Match
Hb	Haemoglobin
HCW	Health Care Workers
HFNC	High Flow Nasal Cannula
HLD	High-Level Disinfectant
HME	Heat Moisture Exchanger
HSS	Hospital Support System
ICL	Invasive Cardiac Laboratory
ICP	Intracranial Pressure
ICU	Intensive Care Unit
IV	Intravenous

List of Abbreviations

IVD	Intravenous Drip
IO	Intestinal Obstruction
IPPV	Intermittent Positive-Pressure Ventilation
L/min	Litre per minute
LA	Local Anaesthesia
LMA	Laryngeal Mask Airway
LSCS	Lower Segment Caesarean Section
m^3	Cubic metre
MAC	Minimum Alveolar Concentration
mcg	Microgram
MH	Malignant Hyperthermia
mls	Milliliter
MLT	Microlaryngeal Tube
mmHg	Millimeter mercury
MR	Magnetic Resonance
MRI	Magnetic Resonance Imaging
MSA	Malaysia Society of Anaesthesiologist
MSBOS	Maximum Surgical Blood Ordering Schedules
NORA	Non-Operating Room Anaesthesia
NPA	Nasopharyngeal Airway
N/Saline, N/S	Normal Saline
N2O	Nitrous Oxide
NBM	Nil By Mouth
O.T	Operation Theatre
O2	Oxygen
OPA	Oropharyngeal Airway

List of Abbreviations

OR	Operation Room
PACU	Post Anaesthesia Care Unit
PCA	Patient Controlled Analgesic
PPE	Protective Personnel Equipment
psi	per square inch
PVC	Polyvinyl Chloride
RBC	Red Blood Cell
RSI	Rapid Sequence Induction
SAB	Subarachnoid Block
SGA	Supraglottic Airway Device
SpO2	Saturation Of Peripheral Oxygen
SSSL	Safe Surgery Save Life
TCI	Target Controlled Infusion
TIVA	Total Intravenous Anaesthesia
TOF	Train Of Four
VIE	Vacuum-Insulated Evaporator
U/S	Ultrasound

PROCEDURE 1 : CHECKING THE ANAESTHESIA MACHINE

Scope	Anaesthesia Technologist is responsible for checking the Anaesthesia Machine and other essential accessories.
Purpose	To ensure Anaesthesia Machine is in good working order for safe anaesthesia delivery.
Materials / Equipment	1. Appropriate PPE 2. Anaesthesia Machine with ventilator and alarm system. i. Gases - Central supply of <> 58.01 psi (4 bar) for: • oxygen • nitrous oxide • medical air - Cylinders: • Oxygen (pin index) – 0.7 m^3 • Nitrous oxide (pin index) – 0.7 m^3 • Pin index cylinder keys - Gas monitor - Gas analyzer/sensors - Breathing circuit system - Test lung - **Other essential apparatus/accessories required:** • Suction apparatus • Face masks • Laryngoscope with blades of various sizes • Oropharyngeal / nasal airways • Supraglottic airways (e.g LMA) • Endotracheal tubes of different sizes • Syringes, • Magill forceps • Stylet/bougie, • Stethoscope

	• Anchoring tape ii. Flowmeters - Gases supply of: • oxygen • nitrous oxide • medical air iii. Vaporizers - Sevoflurane - Desflurane iv. Anaesthetic Breathing System (ABS) - Circle Circuits (adult and pediatric) - Mapleson Breathing System • Mapleson E (Ayre's T-piece) • Mapleson F - Carbon dioxide absorber - Spare reservoir bag v. Anaesthetic Gas Scavenging System (AGSS) 3. Monitoring Devices - Invasive and non-invasive physiological monitors 4. Documentation: - Anaesthesia machine checklist
Work Process	**Level One** 1. Level one check is a detailed check of all systems before being placed into use performed by HSS personnel 2. Applies to all new systems, as well as all systems after servicing or repair **Level Two** **1. Manual Anaesthesia Machine** i. Level two checks should be performed at the start of each anaesthetic list by Anaesthesia Technologist ii. This check should be performed at the beginning of each anaesthetic list, following the protocol for each device and system - Power supply

	• Plugged into uninterrupted power supply (UPS) • Switch on • Back-up battery charged - Gases • Check oxygen, nitrous oxide and medical air supply o Central supply ✓ Check the central supply gas warning light ✓ Check oxygen and nitrous oxide outlets from the wall supply are correctly connected to respective inlets on the machine with a tug test ✓ The pressure gauge shows pressure @ ± 4 bar o Cylinder supply ✓ Disconnect the central supply to the machine ✓ Ensure ➢ The pressure is appropriate ➢ The cylinder can be turned on and off ➢ The content is sufficient (more than 1000 psi) for its intended purpose ➢ The cylinder-yoke fitting does not leak o Observe the respective cylinder pressure gauge on the machine o After completing the checks, ensure the reserve cylinders are turned off ✓ Test oxygen failure warning device ✓ With nitrous oxide and oxygen flowing at 2 L/min, disconnect the oxygen supply ✓ Press the oxygen bypass button to release oxygen pressure in the machine o One Gas Test for anaesthesia Machine ✓ Check that the oxygen analyzer is correctly calibrated and that the low oxygen alarm is functioning ✓ With the oxygen supply "on," disconnect all other gas sources ✓ After other gases have been bled from the machine, open all flowmeter controls

- ✓ Check that only oxygen flows as detected by the oxygen analyzer
- ✓ Restore nitrous oxide flow to the machine
- ✓ Check nitrous oxide flcorrespond with oxygen flowmeter

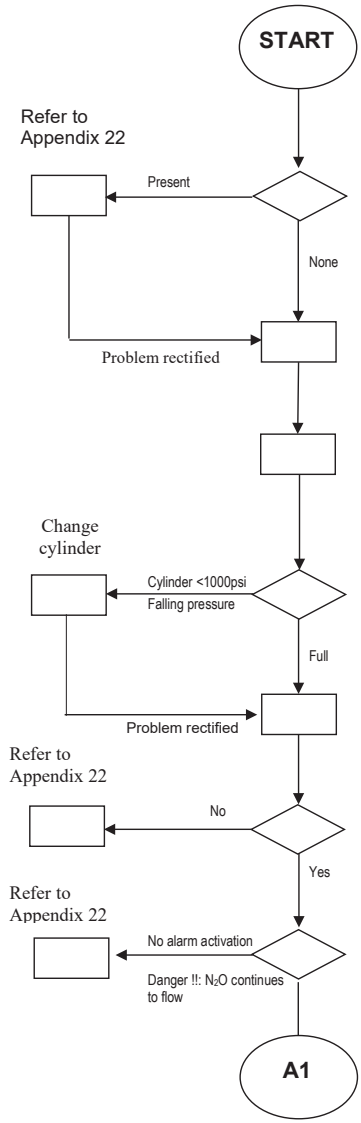
- Flowmeters
  - Ensure that flowmeter bobbins rotate freely within the column
  - Turn off each flowmeter control and oxygen bobbin are at the minimum position (200-300 mL/min)
  - Verify the function of the oxygen supply failure warning and associated anti-hypoxic delivery system
- Vaporizer
  - Check the anaesthetic liquid level is within marked limits
  - Ensure
    - all filling ports are sealed
    - Correct seating, locking and interlocking of detachable vaporizers or cassettes.
  - Leaks test for each vaporizer in the "on" and "off" state.
  - Check for machine leaks upstream from the common gas outlet or breathing system, based on AAGBI Safety Guidelines checking anaesthetic equipment 2012
- Breathing System
  - Circle System
    - Inspect and manually check the breathing system(s) to be used to ensure correct assembly, then commence the tests below:
      - ✓ Check the indicator colour of the carbon dioxide absorbent against the manufacturer's specifications. Change when carbon dioxide absorbent 2/3 exhaustion or presence of CO_2 in rebreathing capnograph @ 5mmHg.
      - ✓ Check the breathing system for leaks
        - ➢ Ensure to close APL valve
        - ➢ The system should maintain a test pressure >30 cm H_2O at a gas flow of 300 ml/min for 5 second

	✓ Test the integrity of the circle breathing system. ➢ Connect a breathing bag to the patient's Y-piece, set an appropriate fresh gas flow and ventilate the breathing system manually bagging ➢ Observe inflation and deflation of the attached breathing bags and associated movement of visible unidirectional valves and feel the system for normal resistance and compliance ➢ At the end of the test, check for easy spill through the adjustable pressure limiting (APL) valve by simultaneously squeezing the two rebreathing bags ✓ Check compliance for each new breathing system if the ventilator uses automatic compliance compensation • Mapleson Breathing System o Visual inspection for cracks, kinks, and discontinuity of the breathing circuit o Ensure the APL valve is functioning o The reservoir bag is prepared according to the patient body weight - Scavenging System • Check the scavenging system is connected correctly • The scavenging flow is adjusted appropriately • External ports or mechanical valves are not blocked - Other Apparatus • Ventilator o Check that gas and electrical connection are correctly connected • Breathing circuit humidifiers • Breathing circuit filters - Documentation • Documentation should include the person performing the check's date, time and identity. • The record should be kept with the relevant anaesthesia machine or device

	2. Digital anaesthesia machine i. Anaesthesia machine varies, depending on brands and models ii. Follow the anaesthesia machine checking instructions **Level Three** 1. Should be performed before commencing anaesthesia for each patient by Anaesthesia Technologist 2. Subsequently in between cases before starting anaesthesia 3. Check the inhalational anaesthesia delivery device (vaporizer) if it has been changed as in item level 2,1. ii (vaporizer) 4. Check the breathing system if it has been changed as in item level 2,1. ii (Breathing system) 5. Check other apparatus, as in item level 2,1. ii (other apparatus) 6. In the event of any faulty machine, perform basic troubleshooting i. Identify and verify the problem involved ii. If unable to fix it, consider changing the machine with an available backup unit iii. Then complain to HSS and refer to BEMs Personnel for further management iv. This measure applies to errors that may crop up before, during, or after any procedure (Procedure & Appendix 22) 7. Documentation
References	AAGBI Safety Guideline. (2021). Checking Anaesthetic Equipment. Retrieved May 6, 2023, from https://www.rcoa.ac.uk/sites/default/Files/documents/2019-11/3%20Checking%20Anaesthetic%20Equipmemt%20-%202012.pdf Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Chu, L. F. & Fuller, A. J. (2012). *Manual of clinical anesthesiology.* China: Lippincott Williams & Wilkins.

	Larry F. C.& Andrea J.F. (2012). *Manual of Clinical Anesthesiology.* Lee, C. Y. (2006). *Manual of anaesthesia.* Singapore: McGraw Hill Education.
Flow Chart	Refer to Appendix 1a – 1h
Revision history	Standard Operating Procedures for Assistant Medical Officers in Anesthesiology MOH (2007)

FLOW CHART OF CHECKING THE ANAESTHESIA MACHINE (MANUAL) BEFORE USE



Check the central supply gas warning light

Power supply

Check central supply
- Medical gases pressure

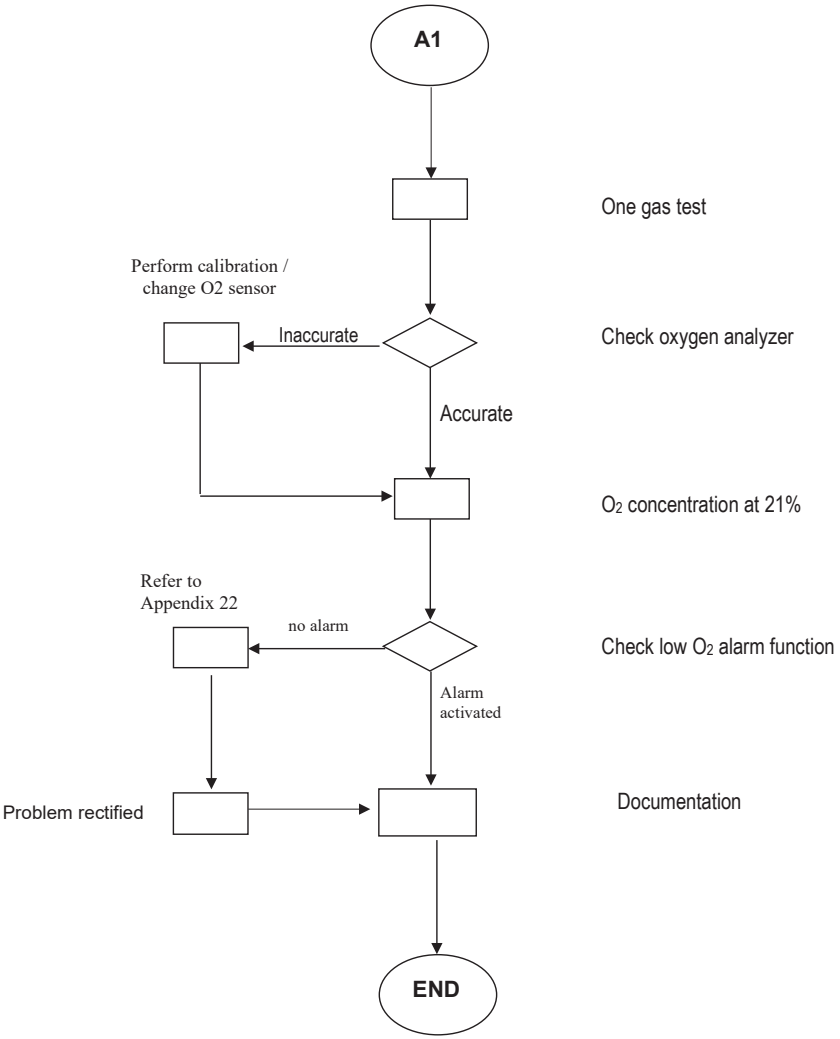
Check cylinder supply
- pressure/weight
- cylinder yoke

Check gas flow

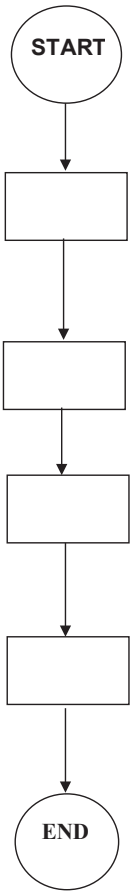
Bobbin rotating freely

Test for oxygen failure warning device.

* With O_2 / N_2O at 2L/min.
- Disconnect O_2 supply.
- Audible alarm activated.
- N_2O flow cut off within 10 sec. The alarm stops when O_2 is restored


A1
One gas test
Perform calibration / change O2 sensor
Inaccurate
Check oxygen analyzer
Accurate
O2 concentration at 21%
Refer to Appendix 22
no alarm
Check low O2 alarm function
Alarm activated
Problem rectified
Documentation
END

FLOW CHART OF CHECKING OF FLOWMETER



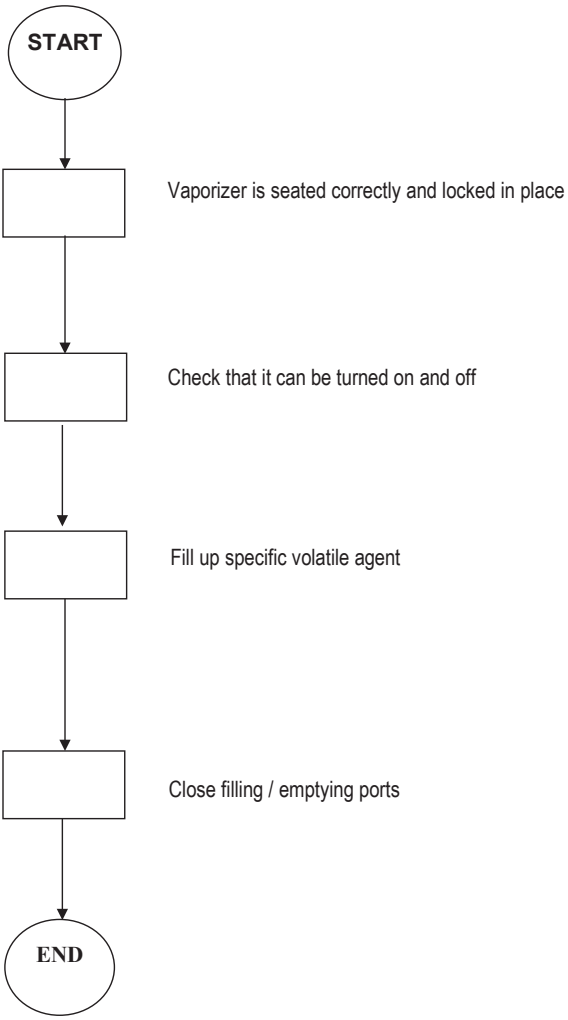
Open all gas supply

Open flowmeter control in turn
- Bobbin rotates freely

Turn off each flowmeter control
- Oxygen Bobbin at 0.2 L/min position

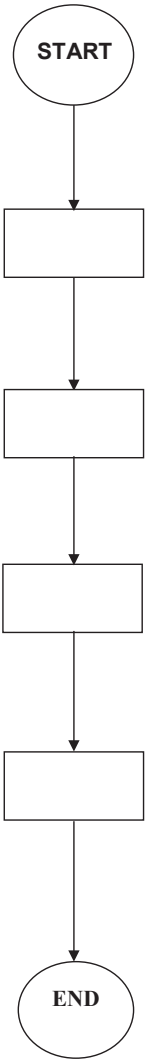
Close gas supply

FLOW CHART OF CHECKING OF VAPORIZER



Appendix 1d

FLOW CHART OF PRECIRCUIT LEAKS TEST



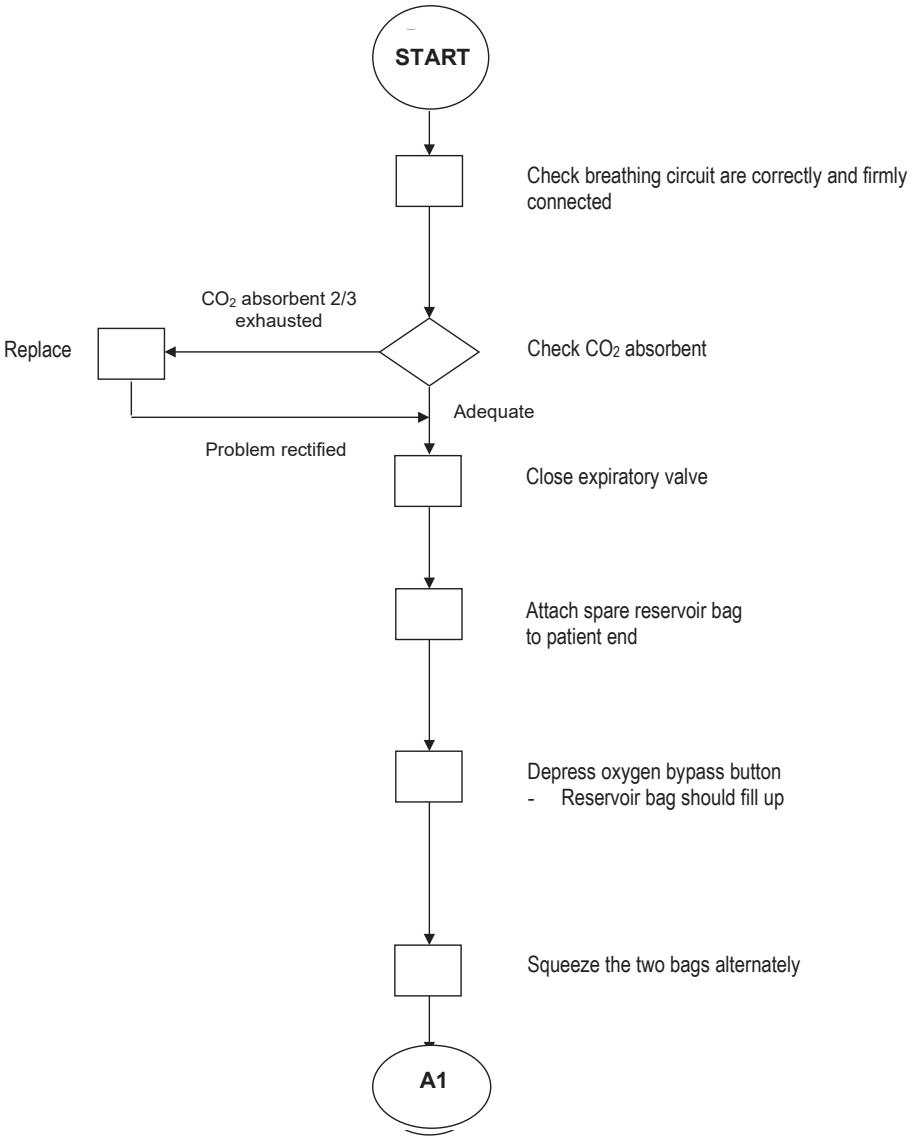
Switch on GA machine and ensure to connect gas supply (*follow the manufacturer guideline*)

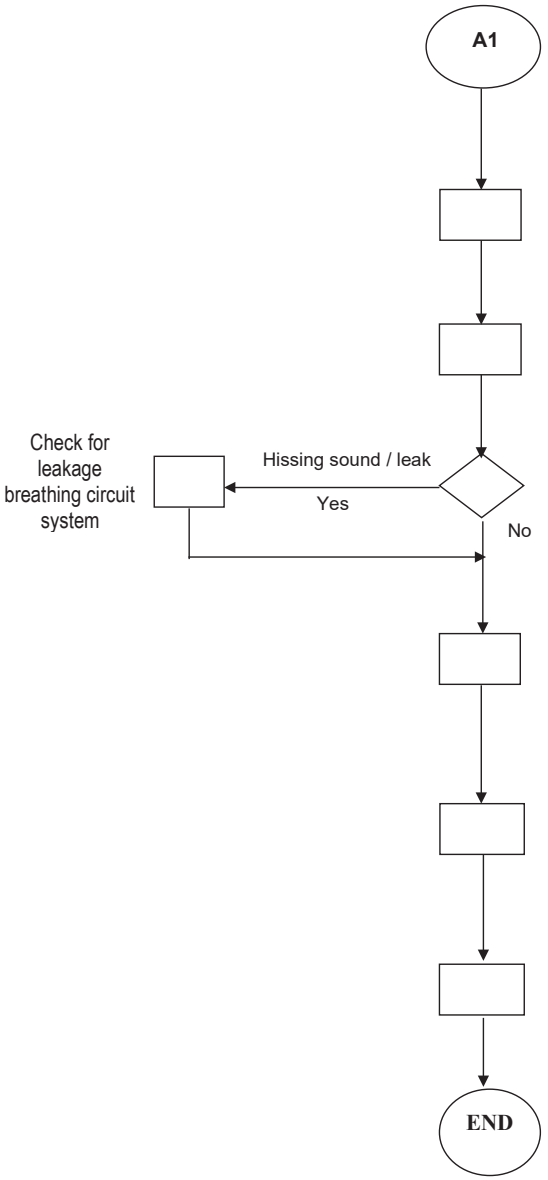
Turn on oxygen flowmeter at 2 L/min

Occlude common gas outlet for 10 seconds
- bobbin should dip (applicable for machine equipped with bobbin)

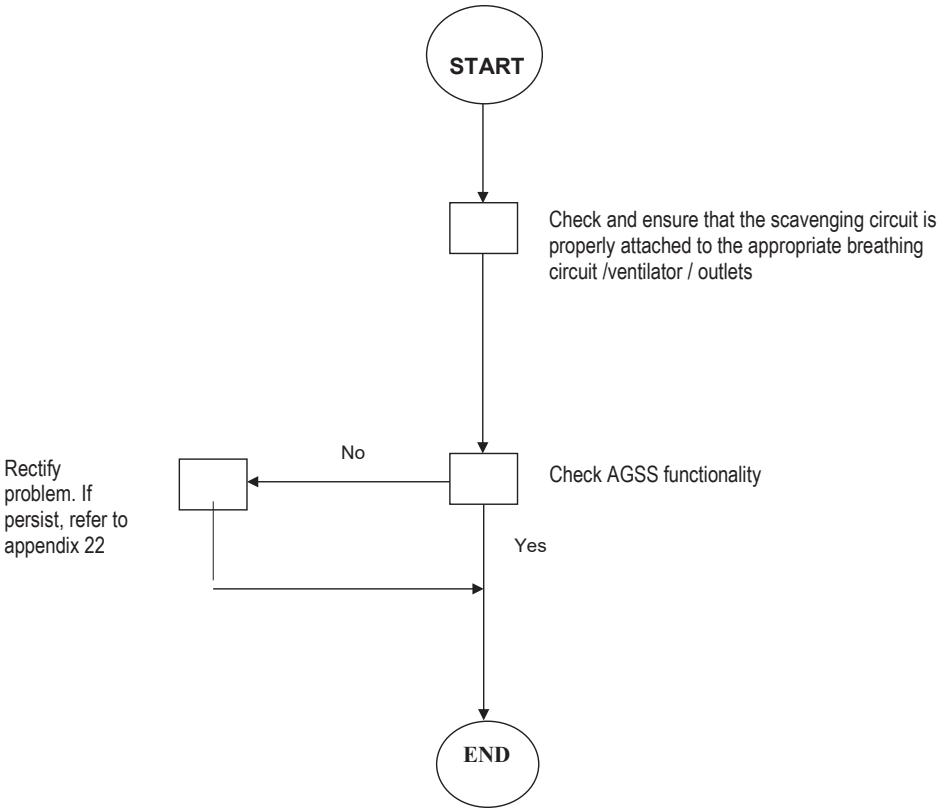
Test each vaporizer 'on' and 'off' in turn

FLOW CHART OF BREATHING SYSTEM

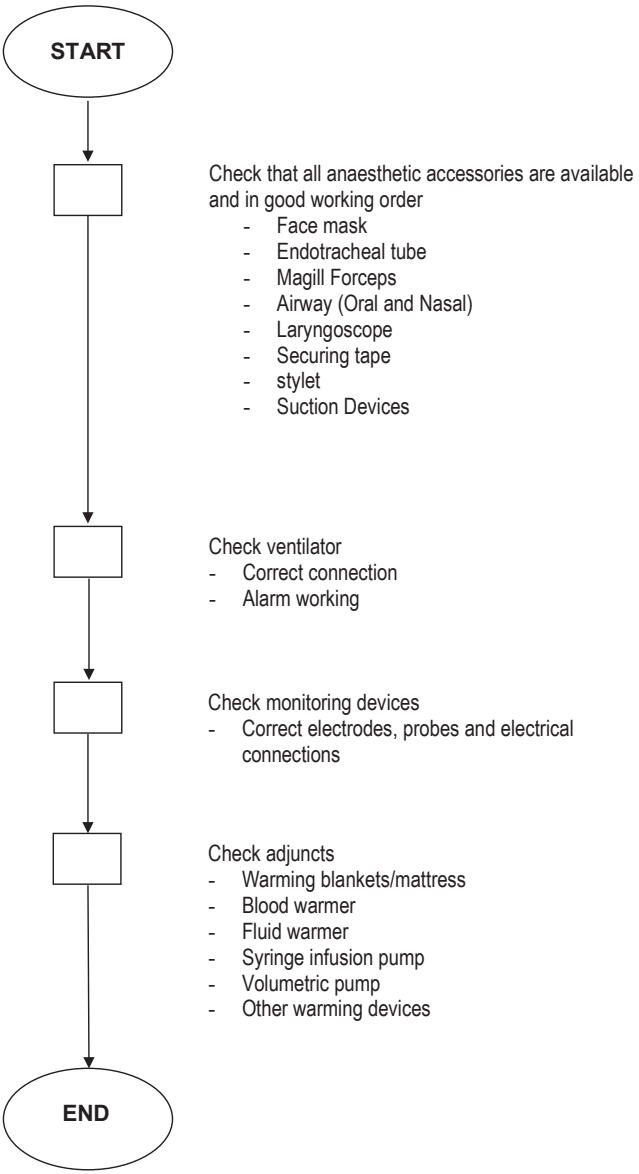



A1
Oxygen passes freely from one bag to the other
Check visually that each unidirectional valve is functioning correctly
Check for leakage breathing circuit system
Hissing sound / leak
Yes
No
Close APL Valve
Maintain at 30cmH2O x 5 secs
- Bags remain inflated
Open expiratory valve
- Gas spills easily when bags are squeezed
Disconnect spare reservoir bag
Replace with mask
END

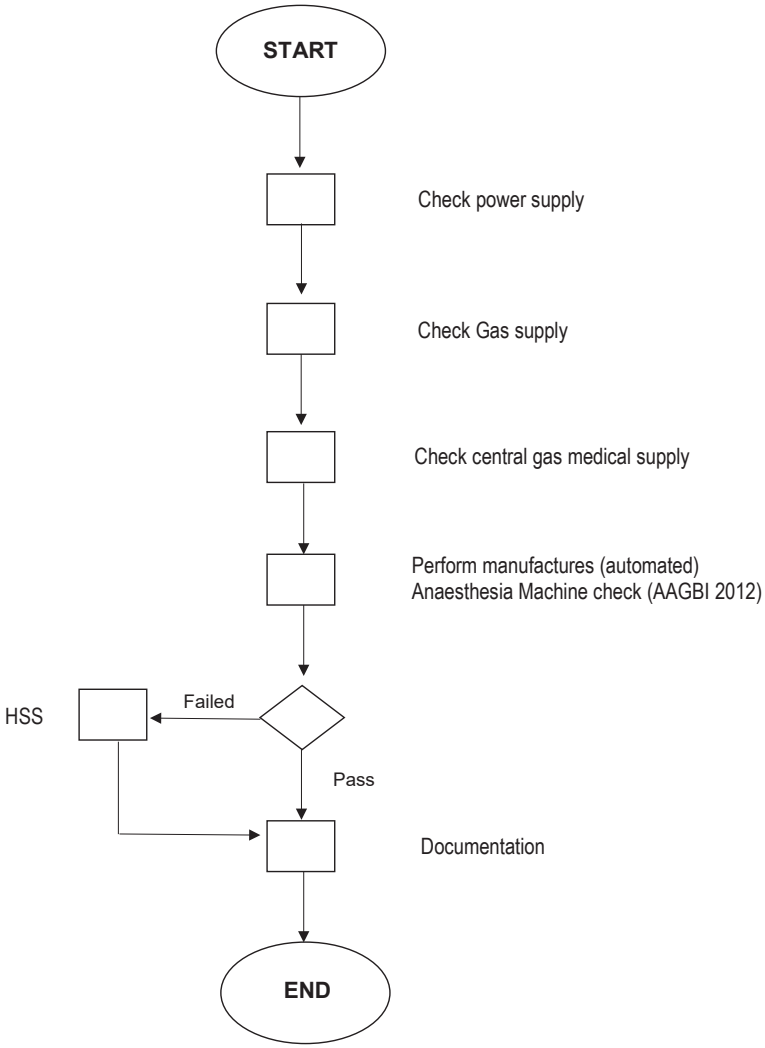
FLOW CHART OF CHECKING OF SCAVENGING SYSTEM



FLOW CHART OF CHECKING ANAESTHETIC ACCESSORIES



FLOW CHART OF CHECKING THE ANAESTHESIA MACHINE (DIGITAL) BEFORE USE



PROCEDURE 2 : PREPARATION OF ANAESTHETIC APPARATUS

Scope	Anaesthesia Technologist is responsible for preparing an anaesthetic apparatus before starting a case.
Purpose	To ensure all essential equipment for use are available and in good working order to deliver safe anaesthesia.
Materials / Equipment	1. Anaesthesia machine i. Volatile agent (Sevoflurane, Desflurane) ii. Bacterial / Viral filters (HMEFs) iii. Breathing circuits 2. Physiological monitors 3. Intubation trolley i. Laryngoscopy set with blades of various sizes ii. Face mask of appropriate size iii. ETT of various sizes (according to patient needs) iv. Oropharyngeal & nasal airway v. Supraglottic airways (SGA) vi. Bougie vii. Stylet viii. Magill forceps 4. Suction apparatus i. Suction catheter ii. Yankauer tip 5. Warming devices i. Warming blanket/mattress ii. Radiant warmer iii. Infusion warming unit (single/double line)

	6. IV access, essential materials, and solution i. Cannula of various sizes ii. Syringes and needles iii. IV drip set iv. Drip stand v. Tourniquet vi. 70% alcohol swab vii. Alcohol-based Hand Rub viii. Securing tape (Tegaderm/plaster) ix. Crystalloids x. Colloids 7. Other related equipment: i. Emergency/Resuscitation trolley with a defibrillator machine ii. Medication cart iii. Screen bar (L-bar) iv. Scissors v. Lubricating jelly vi. Tongue depressor vii. Disposable gloves viii. Arm board/rest ix. Head ring x. Stethoscopes xi. Video laryngoscope if available
Work Process	1. Prepare an anaesthetic machine. (Refer to procedure no.1) 2. Prepare intubation set i. Check and test the laryngoscopy set to ensure it is functioning and safe.

ii. Test ETT cuff integrity, and ensure no leakage and herniation noticed. ETT is clean, lubricated and not malformed.

iii. Airways/ Supraglottic Airways (SGA) choose appropriate size based on bodyweight

iv. Prepare video laryngoscope when applicable

3. Prepare suctioning apparatus (refer to procedure no.2)

4. Prepare warming apparatus:

   i. Warming apparatus according to need

      - Blanket
      - Radiant heater
      - Mattress
      - Tubing
      - Set the warming apparatus to the required temperature

5. Intravenous requirement

   i. Ensure availability as indicated:

      - IV fluid warmer
      - Warm IV fluid
      - Screened and Cross-matched blood, if indicated

6. Prepare other related equipment

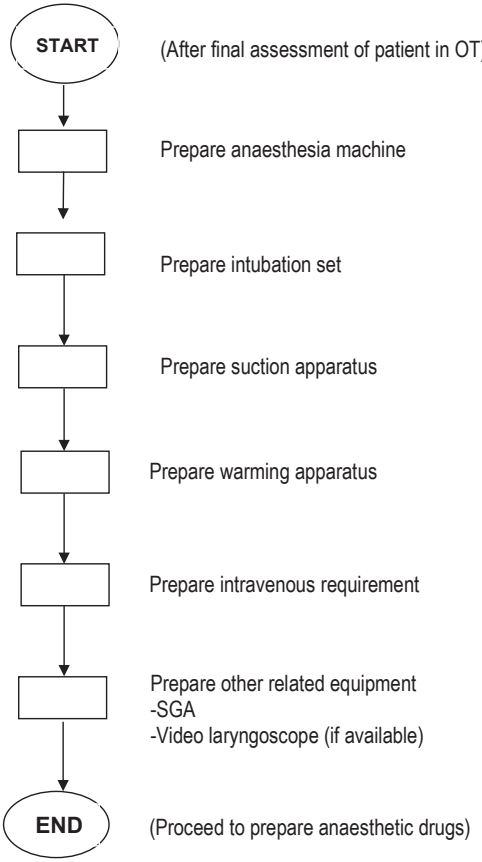
   i. Available as deemed required:

      - Emergency Cart/trolley
      - Video laryngoscope if available
      - Securing tape
      - Scissors
      - Lubricating jelly (KY & LA jelly), Cuff inflator (syringe),
      - Disposable gloves
      - Drip stand, Arm board, Head ring
      - Anti-DVT (Venaflow) machine Set
      - Stethoscopes

	7. Documentation
References	Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Lee, C.Y. & Lim, F. (2014). Recommendations on pre-anesthetic assessment. Kuala Lumpur, Kuala Lumpur, Malaysia: College of Anesthesiologist, Academy of Medicine of Malaysia. Patient Safety Unit & Safe Surgery Saves Life Steering Committee. (2018). *Guidelines on Safe Surgery Saves Lives Programme* (2nd ed.). Kuala Lumpur: Ministry of Health Malaysia. Retrieved February 22, 2022, from https://patientsafety.moh.gov.my/v2/?page_id=867 Somerset, W. B. (2021). Pre-operative evaluation. In B. M. Keech, *Anesthesia Secret* (6th ed., pp. 11-17). Philadelphia: Elsevier.
Flow Chart	Refer to Appendix 2
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

Appendix 2

FLOW CHART ON PREPARATION OF ANAESTHETIC APPARATUS



PROCEDURE 3 : PRE-ANAESTHETIC ASSESSMENT OF PATIENT

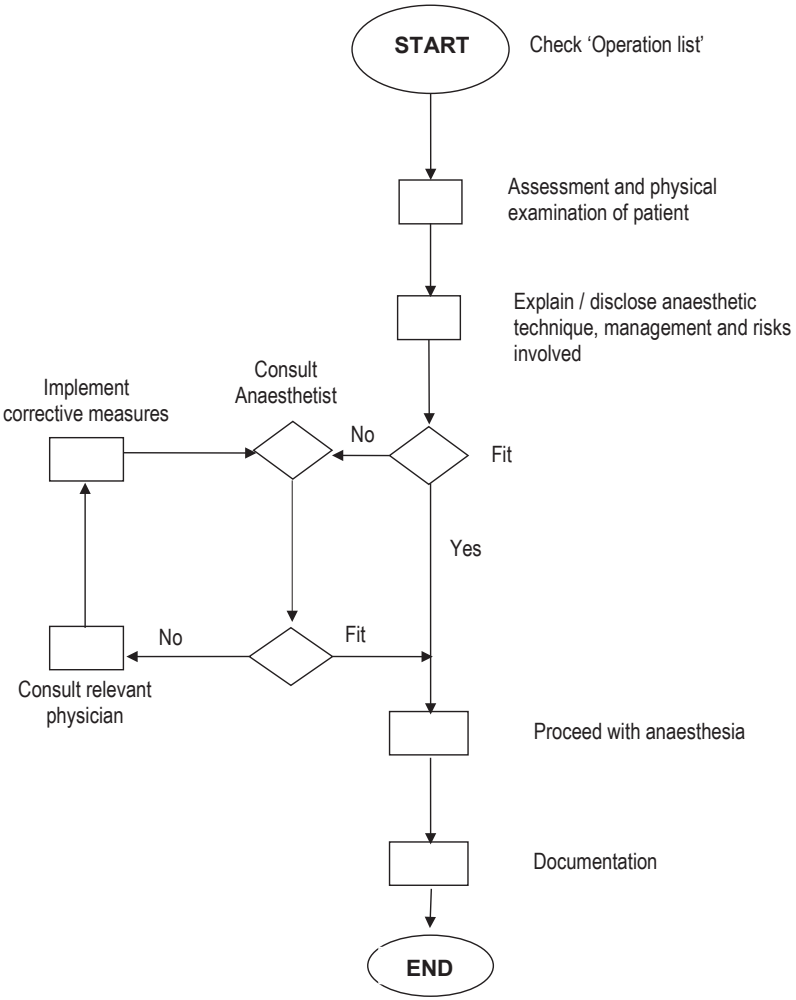
Scope	Anaesthesia Technologist is responsible for carrying out the pre-anaesthetic assessment of patients for Surgery (ASA I & II)
Purpose	Pre-Anaesthetic Assessment is to be carried out to ensure the patient is fit for anaesthesia and surgery. To identify comorbidities that may lead to a patient complication during anaesthesia, surgery and the post-operative period 1. To reduce the risks associated with surgery and anaesthesia 2. To ensure and maintain consistency of quality (thus decreasing the cost) of perioperative care 3. To optimize the patient prior to surgery 4. To obtain the patient's informed consent for the anaesthetic procedure.
Materials / Equipment	1. OT list 2. Patient's case notes 3. Ensure valid consent for: i. Surgery ii. Anaesthesia iii. Blood transfusion 4. Laboratory investigation results (if indicated) 5. X-rays (if indicated) 6. ECG (if indicated) 7. Blood x-matching forms (if indicated) 8. Anaesthetic form (PER-ANAES-301) 9. Safe Surgery Save Lives (SSSL) Form (Version II) 10. Stethoscope 11. Physiological monitors
Work Process	1. Check OT list 2. Assessment and physical examination of the patient

	i. Establish rapport with the patient ii. Confirmation of patient identification (name, gender, age, registration number, identification card number, identification tag) iii. Review of diagnosis and consent for surgery and anaesthesia. iv. Past medical history (medical, surgical, and anaesthetic history, including drug allergies) v. Explain and disclose the anaesthetic technique planned, perioperative management and risks involved vi. Fasting time (refer to MSA Guidelines) vii. Special medication, to continue or omit on the day of surgery viii. Physical examination and airway assessment - Identification of anaesthetic risks: • Difficult intubation • Classification of physical status (according to the American Society of Anaesthesiologist, ASA) ix. Review of relevant investigation results x. GXM blood if indicated (refer MSBOS) xi. Premedication: (optional) - Dose - Route - time of administration 3. Information and health education i. Establish rapport with the patient ii. Explain and disclose the anaesthetic technique planned, perioperative management and risks involved iii. Special medication, to continue or omit on the day of surgery iv. Discuss the plan for post operative pain management if applicable. 4. Unfit patient for anesthesia:

	i. Consult specialist/consultant Anaesthetist ii. Withhold procedure – pending decision from the Anaesthetist iii. Inform the patient/surgeon iv. Refer patient to nearest Specialist hospital (for District hospitals only) v. Stabilize the patient's condition while waiting to transfer to the referral centre. 5. Documentation i. Fill up the 'Anaesthetic Form "PER-ANAES-301" in the pre-anaesthetic assessment section. ii. Ensure 'Anaesthetic Consent' is obtained and endorsed by Medical Officer or Hospital Director
References	Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Lee, C. Y. & Lim F. (2014). Recommendations on pre-anesthetic assessment. College of Anesthesiologists Academy of Medicine of Malaysia in collaboration with Malaysian Society of Anesthesiologists. Patient Safety Unit & Safe Surgery Saves Life Steering Committee. (2018). *Guidelines on Safe Surgery Saves Lives Programme* (2nd ed.). Kuala Lumpur: Ministry of Health Malaysia. Retrieved February 22, 2022, from https://patientsafety.moh.gov.my/v2/?page_id=867 Somerset, W. B. (2021). Pre-operative evaluation. In B. M. Keech, *Anesthesia Secret* (6th ed., pp. 11-17). Philadelphia: Elsevier.
Flow Chart	Refer to Appendix 3
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

Appendix 3

FLOW CHART OF PRE-ANAESTHETIC ASSESSMENT OF PATIENT



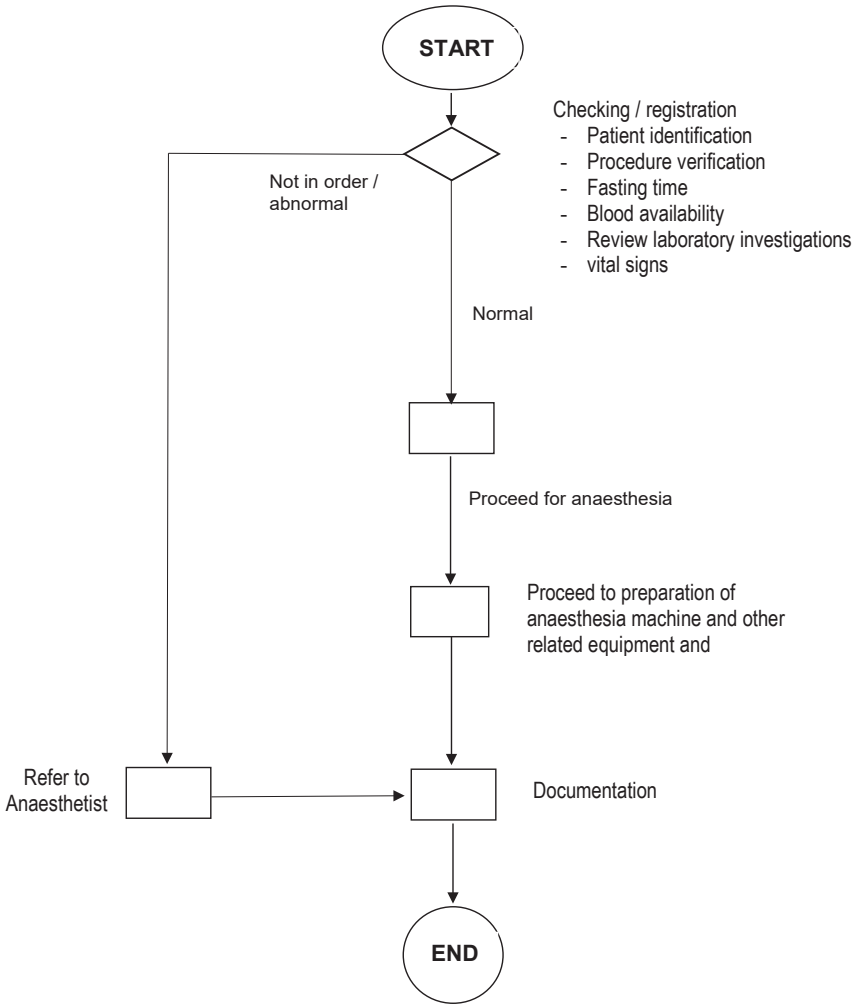
PROCEDURE 4 : MANAGEMENT OF PATIENT IN THE OPERATING THEATRE

Scope	Anaesthesia Technologist is responsible for managing patients with ASA I & II classification
Purpose	To identify or rule out comorbidities that may lead to a patient complication during anaesthesia, surgery and post-operative period and to ensure all essential requirements are available and all required parameters are within normal values.
Materials / Equipment	1. Case notes 2. Operation list 3. SSSL Form 4. Anaesthetic form 5. Valid consent form for anaesthesia, surgery and blood transfusion 6. Laboratory investigation results / reports 7. Physiological monitoring devices i. ECG ii. SpO2 iii. Blood pressure iv. Temperature probe 8. IV cannulation set 9. Stethoscope 10. Warming devices
Work Process	1. Checking and registration (air lock) i. Patient identification: - Name, date, gender, age, registration number, identification card number and identification tag - Ensure the right patient and right surgery ii. Procedure verification:

	- Consent for Operation, Anaesthesia and Blood transfusion - Register patient 2. Final assessment of the patient in the operating room i. Check and reassess the patient's hemodynamic status to ensure vital signs are within normal range ii. Review laboratory investigations results and chest X-ray as indicated and ascertain results/findings are within normal range iii. Check availability and viability of IV access iv. General systems review: - Previous medical and surgical history - To find out whether any medication - Ascertain allergic condition - Previous history of surgery (eventful or uneventful) - History of difficult airway management - ASA physical classification: ASA I and II - Note urine output (if the patient has an indwelling catheter) - Standard fasting hours (Refer MSA Guidelines) - Document all findings in anaesthetic record form (PER-ANAES-301) - Blood availability if indicated. (GXM or GSH) 3. Review findings and assessment i. Prepare patient for anaesthesia ii. Assessment, findings and documentation verified. iii. Refer patient to Anaesthetist / postpone or cancel the case should assessment, findings and documentation be unsatisfactory.
References	Lee, C. Y. (2006). Manual Anesthesia. Singapore: McGraw Hill Education Larry F. C.& Andrea J.F. (2012). *Manual of Clinical*

	Anaesthesiology
Flow Chart	Refer to Appendix 4
Revision history	2007 Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF FINAL ASSESSMENT OF PATIENT IN OPERATING THEATRE



PROCEDURE 5 : PREPARATION AND ADMINISTRATION OF ANAESTHETIC DRUGS

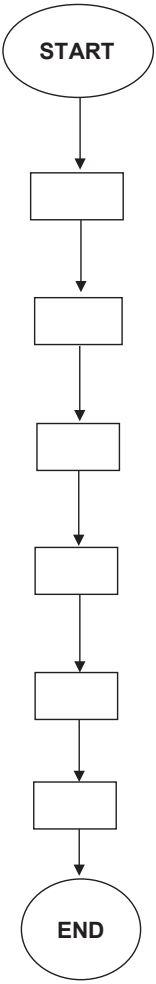
Scope	Anaesthesia Technologist is responsible for preparing and administering anaesthetic drugs as indicated.
Purpose	To ensure all the required drugs are available, labelled, and the required dosage tailored according to the patient's need to ensure safe anaesthesia delivery.
Materials / Equipment	1. Syringes: 10 mls, 5 mls, 3 mls, 1 ml 2. Drawing needles 3. Sharp bin 4. Sterile water for injection 5. Induction agents (dosage/ bodyweight) i. Propofol 2 mg/kg ii. Ketamine 1-2 mg/kg iii. Thiopentone 3-5 mg/kg 6. Neuromuscular blocking agent (muscle relaxant): i. Suxamethonium 1-2 mg/kg ii. Rocuronium 0.6-0.9 mg/kg iii. Atracurium 0.5-0.6 mg/kg iv. Cisatracurium 0.15-0.2 mg/kg 7. Analgesic: i. Fentanyl 1 - 2 mcg/kg ii. Morphine 0.1 - 0.2 mg/kg iii. Pethidine iv 0.5 - 2 mg/kg iv. Remifentanil 0.5 – 1 mcg/kg/min (infusion) 8. Sedation: i. Midazolam 0.1 – 0.2 mg/kg 9. Reversal agents:

	i. Neostigmine 0.05mg/kg with Atropine 0.02mg/kg ii. Glycopyrrolate 200 – 400 mcg (as indicated) iii. Sugammadex 2 – 16 mg/kg (if Rocuronium was used) 10. Other drugs, as indicated i. Ephedrine 6 mg/ml (for SAB) ii. Phenylephrine 0.1mg/ml ii. Adrenaline 11. Medication tray
Work Process	1. Obtain anaesthetic drugs and check i. Ensure not expired ii. Choose an induction agent, muscle relaxant, and analgesic depending on the type of surgery and technique of anaesthesia and clinical condition of the patient 2. Drug dilution and labelling i. Open vial/ampoule ii. For powdered drugs, add the correct amount of water /diluent for injection iii. Withdraw the required dosage of the drug into the syringe iv. Ensure correct labelling 3. Precaution i. Keep empty vial/ampoule until the surgery is over ii. Recheck vial/ampoule (if a patient encounters any side effects) iii. Document incident in anaesthetic form (PER-ANAES-301) iv. Report any Adverse Drugs Reaction (ADR) if indicated. - Take blood for investigation - Fill up ADR Form 4. Disposal i. Discard used syringes, ampoules and needles into sharp bin.

References	Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Lee, C.Y. & Lim, F. (2014). Recommendations on pre-anesthetic assessment. Kuala Lumpur, Kuala Lumpur, Malaysia: College of Anesthesiologist, Academy of Medicine of Malaysia. Patient Safety Unit & Safe Surgery Saves Life Steering Committee. (2018). *Guidelines on Safe Surgery Saves Lives Programme* (2nd ed.). Kuala Lumpur: Ministry of Health Malaysia. Retrieved February 22, 2022, from https://patientsafety.moh.gov.my/v2/?page_id=867 Somerset, W. B. (2021). Pre-operative evaluation. In B. M. Keech, *Anesthesia Secret* (6th ed., pp. 11-17). Philadelphia: Elsevier.
Flow Chart	Refer to Appendix 5
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

Appendix 5

FLOW CHART OF PREPARATION AND ADMINISTRATION OF ANAESTHETIC DRUGS



Check name, dosage, concentration, and expiry date of drug to be used

Open vial / ampoule

Withdraw required dosage of drug into syringe

Label name and dosage of drugs on syringe

Keep empty vial / ampoule until surgery is over

Discard used syringes, ampoules and needles into sharp bin after operation with proper documentation.

(Proceed to preparation of patient for anaesthesia)

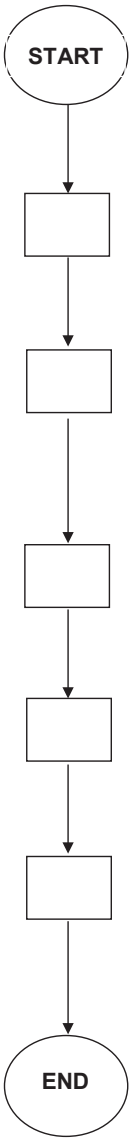
PROCEDURE 6 : PREPARATION OF PATIENT FOR GENERAL ANAESTHESIA

Scope	Anaesthesia Technologist is responsible for preparing patients for General Anaesthesia
Purpose	Ensure safe conduct of anaesthesia
Materials / Equipment	1. Please refer to Procedure No. 4 2. Anaesthetic form (PER-ANAES-301)
Work Process	1. Preparation of patient i. Ensure the right patient, right surgery, operation site, blood investigation within normal values and valid consent taken. Introduction and explanation: - - Introduce yourself to patient ii. Inform and explain the procedure clearly to the patient iii. Position the patient appropriately iv. Set additional IV access (if required) v. Monitor vital signs according to MSA Guidelines (Minimum Monitoring for Anaesthesia 5TH edition, 2022) vi. Keep the suction machine on and ready to use 2. Pre-oxygenation of patient i. Instruct patient to take normal breathing with 100% oxygen through facemask for 3 – 5 minutes 3. Ready for induction Please refer to Induction of Anaesthesia (Procedure No. 7)
References	Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education.

	Lee, C.Y. & Lim, F. (2014). Recommendations on pre-anesthetic assessment. Kuala Lumpur, Kuala Lumpur, Malaysia: College of Anesthesiologist, Academy of Medicine of Malaysia. Patient Safety Unit & Safe Surgery Saves Life Steering Committee. (2018). *Guidelines on Safe Surgery Saves Lives Programme* (2nd ed.). Kuala Lumpur: Ministry of Health Malaysia. Retrieved February 22, 2022, from https://patientsafety.moh.gov.my/v2/?page_id=867 Recommendation for Patient Safety and Minimal Monitoring Standards During Anaesthesia and Recovery 5TH Edition. (2022). *Collage of Anaesthesiologist Academy of Medicine Malaysia*. Malaysia Society of Anaesthesiologist. https://www.msa.net.my/view_file.cfm?fileid=230 Somerset, W. B. (2021). Pre-operative evaluation. In B. M. Keech, *Anesthesia Secret* (6th ed., pp. 11-17). Philadelphia: Elsevier.
Flow Chart	Refer to Appendix 6
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

Appendix 6

FLOW CHART ON PREPARATION OF PATIENT FOR GENERAL ANAESTHESIA



(After preparation of anaesthetic drugs)

Introduction / explanation
- introduce yourself to patient
- explain procedure to patient

Position patient
- supine
- arm board
- warming apparatus

- Ensure IV drip working well

- Monitor vital signs.
  (Refer to MSA minimum monitoring guidelines 5TH edition, 2022)

Preoxygenate patient with 100 % oxygen

(Proceed to induce patient)

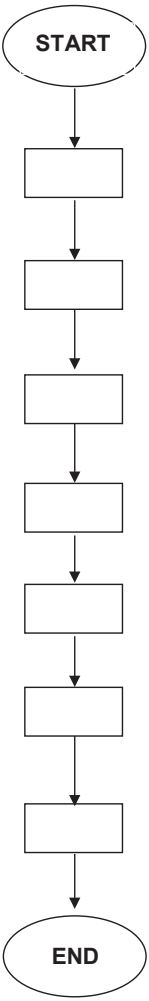
PROCEDURE 7 : INDUCTION OF ANAESTHESIA FOR ELECTIVE GENERAL ANAESTHESIA (IPPV)

Scope	Anaesthesia Technologist is responsible for performing induction of anaesthesia for patients undergoing surgery.
Purpose	To render the patient unconscious.
Materials / Equipment	Please refer to procedure no. 4
Work Process	1. Pre-oxygenation i. Maintain the patient in the supine position ii. Pre-oxygenate with 100% O2 (3 – 5 minutes normal breathing) 2. Induction of anaesthesia using IV agents i. Titrate according to the calculated dosage ii. Dosage of drugs: - Analgesic agent: • Fentanyl 1 – 2 mcg/kg - Induction agent: • Propofol 2 mg/kg • Thiopentone sodium 3 - 5mg/kg • Ketamine 1 - 2mg/kg • Midazolam 0.1 - 0.2mg/kg iii. Apply “BURP” manoeuvre (Cricoid pressure if required) iv. Test for airway patency (able to ventilate) v. Administer muscle relaxant for intubation - Muscle Relaxant: • Atracurium besylate 0.5 - 0.6 mg/kg • Rocuronium bromide 0.6 - 0.9 mg/kg • Cisatraccurium 0.15 – 0.2 mg/kg

	vi. Ventilate manually for 3 minutes for a non-depolarizing neuromuscular blocking agent vii. To consider (if RSI): - Suxamethonium Chloride inj. 1mg - 2mg/kg body weight • Wait for fasciculation to subside 3. Proceed with intubation *(Refer to intubation protocol)* 4. Documentation (Anesthetic form PER-ANAES-301)
References	Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Lee, C.Y. & Lim, F. (2014). Recommendations on pre-anesthetic assessment. Kuala Lumpur, Kuala Lumpur, Malaysia: College of Anesthesiologist, Academy of Medicine of Malaysia. Patient Safety Unit & Safe Surgery Saves Life Steering Committee. (2018). *Guidelines on Safe Surgery Saves Lives Programme* (2nd ed.). Kuala Lumpur: Ministry of Health Malaysia. Retrieved February 22, 2022, from https://patientsafety.moh.gov.my/v2/?page_id=867 Somerset, W. B. (2021). Pre-operative evaluation. In B. M. Keech, *Anesthesia Secret* (6th ed., pp. 11-17). Philadelphia: Elsevier.
Flow Chart	Refer to Appendix 7
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

Appendix 7

FLOW CHART ON INDUCTION OF ANAESTHESIA FOR ELECTIVE GENERAL ANAESTHESIA (IPPV)



PROCEDURE 8 : PREPARE AND PERFORM ENDOTRACHEAL INTUBATION

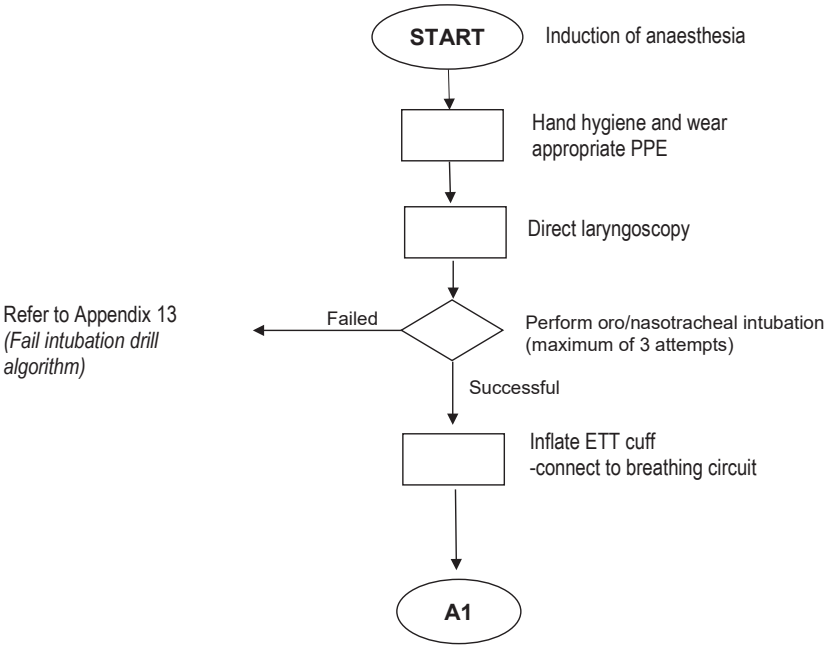
Scope	Anaesthesia Technologist perform endotracheal intubation for patients undergoing surgery under general anaesthesia
Purpose	Securing the patient's airway and providing ventilation via an endotracheal tube (ETT) for the patient undergoing anaesthesia and surgery
Materials / Equipment	1. Refer to procedure no. 2 (apparatus and essential materials) 2. Medication: please refer to procedure no. 5 3. PPE (Appropriate). 4. SSSL form 5. Anaesthesia form (PER-ANAES-301) 6. Anaesthesia consent. 7. High-risk consent (where applicable) 8. Intubation – MALES: i. M: - Mask - Medication - Magill forceps - Machine or manual resuscitation bag - Physiological monitoring system ii. A: - airway (oropharyngeal, nasopharyngeal) iii. L: - Laryngoscope (assorted sizes of blade and type, various handles) iv. E: - EtCO2 (confirmation of ETT placement) - Emergency trolley v. S: - Stylet - SGA - Stethoscope - Suction apparatus • suction catheter 3 different sizes • yankauer – appropriate size

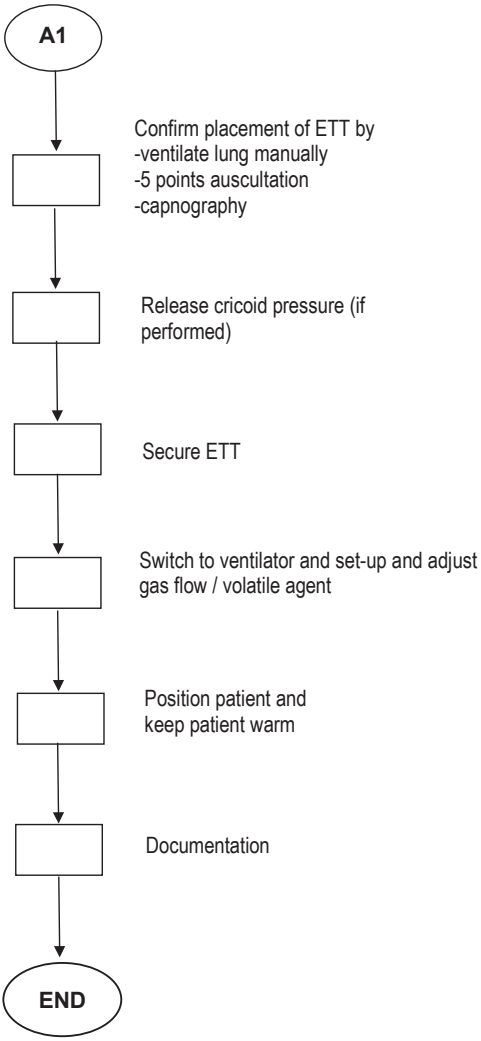
	- Securing tape – anchoring ETT - Scissor 9. Medication: i. Analgesia ii. Induction or sedative agent iii. Neuromuscular blocking agent 10. Head-ring 11. Anaesthesia machine 12. Physiological monitoring system 13. Adequate IV access\Fluid management system
Work Process	1. Intubation *(Choice of oral or nasal intubation – depending on surgery)* i. **Oro-tracheal Intubation** - Ensure suction apparatus is available and functioning during the procedure - Place the patient's head in the sniffing position - Open the patient's mouth - Perform laryngoscopy by introducing an appropriate size blade into the oral cavity gently between the tongue & palate - Glide the tongue to the left side with the blade's tip resting in the vallecula - Clear secretions, saliva, blood - Visualize the pharyngeal area, epiglottis, and glottic opening before gently introducing ETT into the trachea - Apply BURP (backwards, upward, rightward pressure) manoeuvre (external laryngeal manipulation) on the thyroid cartilage to improve visualization of the larynx during intubation (when needed) - The procedure should not take longer than 30 seconds. - Insert ETT into the trachea until the distal end of the cuff within the black line of the tube) has passed vocal cords • Inflate the ETT cuff until no audible air leakage at peak airway pressure (25 - 30 cm H_2O) - Connect ETT to the breathing circuit - Ventilate manually to confirm ETT placement by performing 5 points of chest auscultation and capnography

	- Anchored the ETT with securing tape - Cover the eyes (except for the ophthalmic surgery) ii. **Nasotracheal intubation** - Place the patient's head in the sniffing position - Gently introduce ETT into naris at a plane perpendicular to face - Slowly advance ETT through the nose, nasopharynx, and oropharynx before laryngoscopy - Open patient mouth - Perform laryngoscopy by introducing an appropriate size blade into the oral cavity gently between the tongue & palate - Glide the tongue to the left side with the tip of the blade resting in the vallecula - Clear secretions - Visualize the pharyngeal area, epiglottis and glottic opening - Gently advance the distal end of ETT through cords by using Magill forceps - To refer to the oral intubation procedure for the subsequent process 2. Ventilation i. Switch 'ON' and set the ventilator according to the patient's need ii. Monitor vital signs iii. Set gas flow and anaesthetic agent (vaporiser) iv. Pack throat when indicated (dental, ENT and paediatric) v. Cover eyes with tape or an eye pad (except for ophthalmic surgery) 3. Maintenance of anaesthesia and observation of patient intraoperatively i. Monitor vital signs ii. Vital signs recorded at 5 minutes interval (stable patient) iii. Position patient accordingly iv. Maintain a level of anaesthesia and allow surgical procedures to proceed - Documentation of all clinical management and drugs given is mandatory - Document all incidences (NIA) pertaining to intubation if any.

References	Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Grable, B. &. (2015). Patient Monitoring. In P. K. Sikka, *Basic Clinical Anesthesia* (pp. 70 - 74). New York: Springer. doi:10.1007/978-1-4939-1737-2 Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Williamson, D., & Nolan, J. (2015). Airway assessment. In A. B. Burtenshaw (Ed.), *Emergency Airway Management* (2nd ed., Vol. 41). London: Cambridge University Press.
Flow Chart	Refer to Appendix 8
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART PREPARE AND PERFORM ENDOTRACHEAL INTUBATION




A1
Confirm placement of ETT by
-ventilate lung manually
-5 points auscultation
-capnography
Release cricoid pressure (if performed)
Secure ETT
Switch to ventilator and set-up and adjust gas flow / volatile agent
Position patient and keep patient warm
Documentation
END

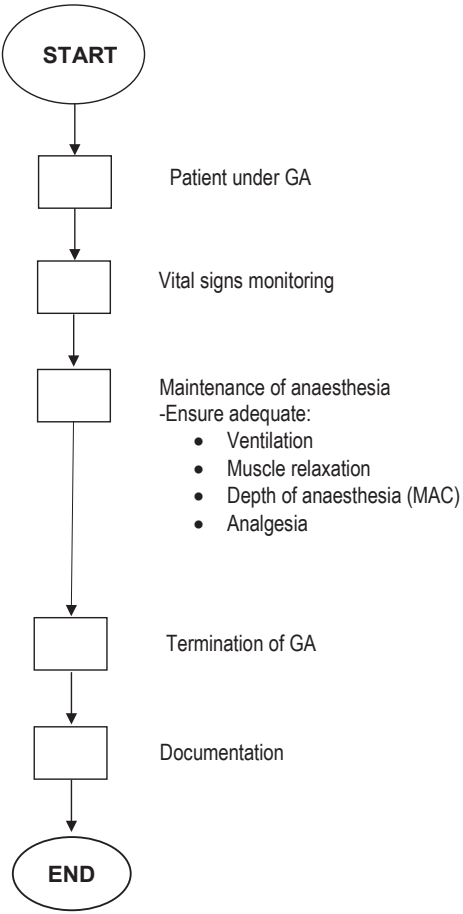
PROCEDURE 9 : MAINTENANCE OF GENERAL ANAESTHESIA (IPPV)

Scope	Anaesthesia Technologist is responsible for maintaining general anaesthesia for patients undergoing surgical procedures
Purpose	Provide balance, effective and safe delivery of General Anaesthesia to ensure adequate muscle relaxation, pain relief, and patient well anaesthetized during the procedure
Materials / Equipment	1. Please refer to procedures no.2 (preparation of anaesthetic apparatus) and no. 5 (preparation and administration of anaesthetic drugs) 2. Anaesthetic form (PER-ANAES-301)
Work Process	1. Maintenance of anaesthesia Maintain adequate level of anaesthesia for surgical procedure to proceed. i. Maintain anaesthesia until the procedure is completed ii. Monitor continuously for adequate ventilation iii. Administer analgesic accordingly iv. Continuous monitoring of vital signs v. Note down time of muscle relaxant administered - Top up if indicated (1/4 of initial dose) - Use a peripheral nerve stimulator if available. vi. Maintain normal physiological body functions vii. Continuous mechanical ventilation (IPPV), if indicated viii. Monitor and record vital signs every 5 minutes. ix. Normal capnography. x. Maintain minimal alveolar concentration (MAC) xi. Maintain SpO_2 within 98-100%. xii. Observe blood loss and document it xiii. Manage IV fluid appropriately xiv. Keep patient warm to prevent hypothermia

	xv. Ensure adequate urine output (½ - 1 ml/kg/hr) if CBD is inserted 3. Termination of anaesthesia (refer to procedure no.10 for reversal of anaesthesia and endotracheal extubation) 4. Documentation
References	Bahati, K. B. & Lahera, V. V. (2015). Understanding Anaesthetic Equipment & Procedure Approach: A Practical Approach. New Delhi: Jaypee Brothers Medical Publisher (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Grable, B. &. (2015). Patient Monitoring. In P. K. Sikka, *Basic Clinical Anesthesia* (pp. 70 - 74). New York: Springer. doi:10.1007/978-1-4939-1737-2 Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Williamson, D., & Nolan, J. (2015). Airway assessment. In A. B. Burtenshaw (Ed.), *Emergency Airway Management* (2nd ed., Vol. 41). London: Cambridge University Press.
Flow Chart	Refer to Appendix 9
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

Appendix 9

FLOW CHART OF MAINTENANCE OF GENERAL ANAESTHESIA (IPPV)



PROCEDURE 10 : REVERSAL OF ANAESTHESIA AND ENDOTRACHEAL EXTUBATION

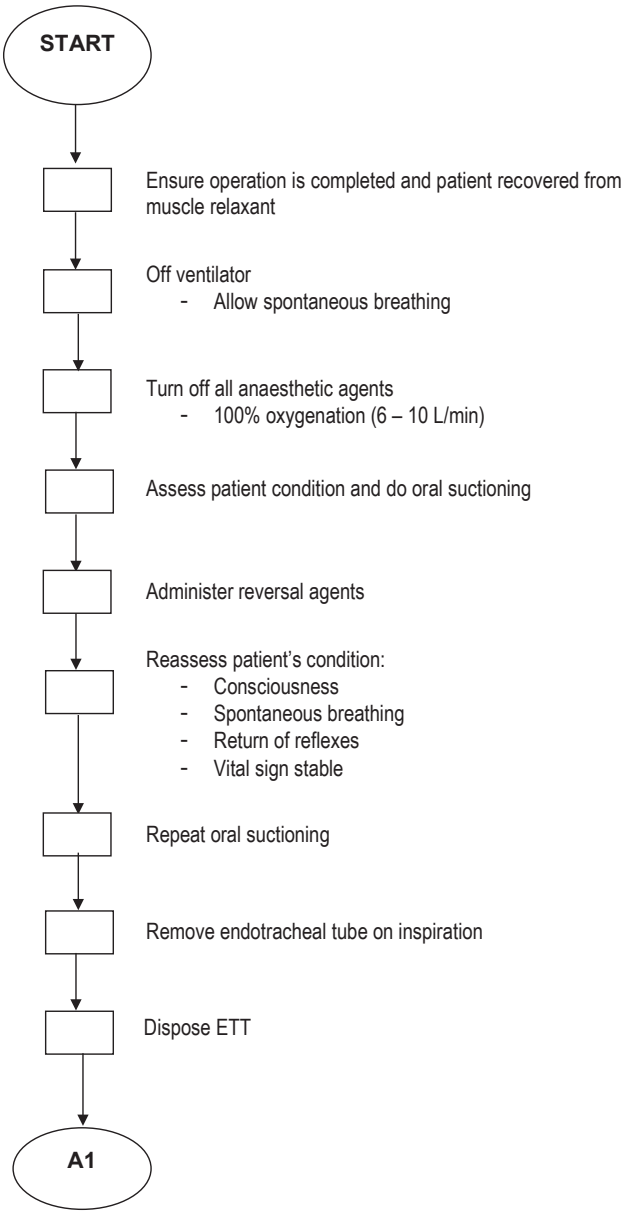
Scope	Anaesthesia Technologist is responsible for managing endotracheal extubation for patients who have undergone surgery at the end of anaesthesia.
Purpose	To ensure the safe reversal of anaesthesia and endotracheal extubation at the end of surgery.
Materials / Equipment	1. Hand hygiene 2. PPE 3. Oxygen 4. Capnometry 5. Reversal agents: i. Neostigmine with Atropine / Glycopyrrolate ii. Sugammadex 6. Physiological monitoring system 7. Face masks 6. Laryngoscope set 7. Oropharyngeal Airways 8. Supraglottic Devices 9. Endotracheal tube 10. Bougie/stylet 11. Stethoscope 12. Anesthetic form PER-ANAES 301 (recovery column & discharge column) 14. Radiant warmer 15. Suction apparatus with Yankauer 16. Documentation
Work Process	**Termination of anaesthesia:** 1. Titrate gases and volatile agents towards the end of the procedure

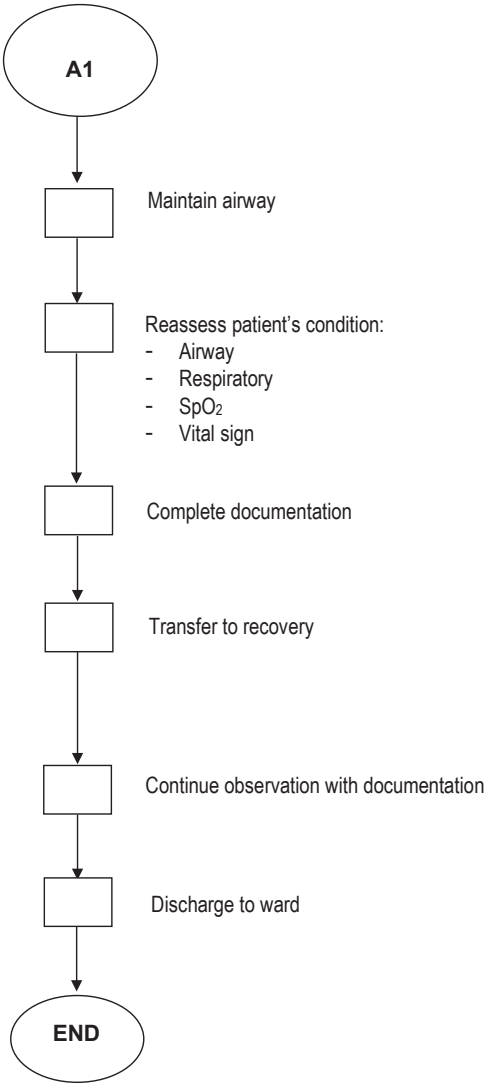
2. Off gases and turn off volatile anaesthetic agent
3. Apply bite block if indicated
4. Reversal
    i. Note the time of the last top-up of the muscle relaxant
    ii. Switch to manual ventilation.
    iii. Look for signs of spontaneous respiration and, if present to, assist with manual ventilation
    iv. Give 100% oxygen
    v. Oral suctioning when necessary
    vi. Administer reversal agent
        - Neostigmine 0.05mg/kg with
        - Atropine 0.02mg/kg
            OR
        - Glycopyrrolate 200mcg – 400mcg (as indicated)
        - Sugammadex 2mg/kg (if indicated)
5. Extubation
    i. Assess patient for:
        - Stable vital signs:
            - ECG
            - NIBP
            - SpO_2 (98-100 %)
    i. Spontaneous respiration
        - Adequate tidal volume and regular breathing
    ii. Consciousness
        - Able to open eyes/mouth
        - Respond to call
    iii. Return of motor strength
        - Good hand grip

	- Able to lift head iv. Repeat oral suctioning if necessary v. Deflate the cuff and then remove the endotracheal tube vi. Prop-up position vii. Maintain airway and oxygenation via face mask viii. Reassess the patient's vital signs ix. Complete documentation 6. Recovery i. Handover to recovery staff ii. Give oxygen iii. Keep patient warm iv. Continue monitoring vital signs for a minimum of 30 minutes v. Complete the anaesthetic record 7. Discharge i. Assess the patient's condition ii. Pain score < 4 iii. Confirm fitness for discharge - Satisfactory recovery score (6/6) iv. Give discharge instructions 8. Documentation
References	Bahati, K. B. & Lahera, V. V. (2015). Understanding Anaesthetic Equipment & Procedure Approach: A Practical Approach. New Delhi: Jaypee Brothers Medical Publisher (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Grable, B. &. (2015). Patient Monitoring. In P. K. Sikka, *Basic Clinical Anesthesia* (pp. 70 - 74). New York: Springer. doi:10.1007/978-1-4939-1737-2

	Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Sturgess, D. J. (2014). Hemodynamic Monitoring. In A. D. Bersten, *Oh's Intensive Care Manual* (7th ed., pp. 122 - 137). China: Butterworth Heinemann Elsevier.
Flow Chart	Refer to Appendix 10
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF REVERSAL OF ANAESTHESIA AND ENDOTRACHEAL EXTUBATION




A1
Maintain airway
Reassess patient's condition:
- Airway
- Respiratory
- SpO_2
- Vital sign
Complete documentation
Transfer to recovery
Continue observation with documentation
Discharge to ward
END

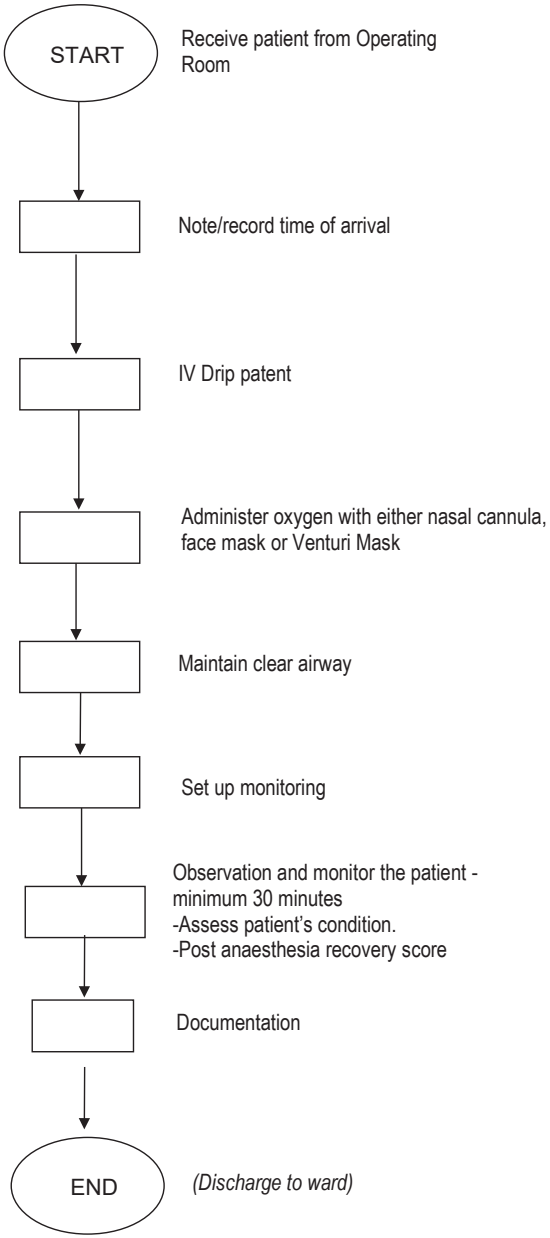
PROCEDURE 11 : POST ANAESTHESIA CARE

Scope	Anaesthesia Technologist is responsible for the management of Patients in Post Anaesthesia Care
Purpose	Post Anaesthesia Care to optimize patient status, reduces post-operative adverse events, provides a uniform recovery assessment, and streamlines postoperative care and discharge criteria
Materials / Equipment	1. Physiological monitor 2. Anaesthetic form (PER-ANAES-301) 3. Warming devices 4. Suction apparatus 5. Resuscitation equipment 6. Facemask or Ventimask (when necessary/if applicable) 7. Nasal cannula 8. Analgesic / Opioids (IV. Morphine/Fentanyl/Pethidine) 9. Patient transfer trolley
Work Process	1. Receiving patient i. Note the time received patient at the recovery bay in the anaesthetic form PER-ANAES 301 ii. Ensure intravenous drip is pattern 2. Maintain oxygenation i. Administer oxygen (when necessary) ii. Avoid hypoxaemia and maintain SPO2 at 98 – 100% 3. Maintain clear airway i. Supine position / lateral ii. Suctioning when necessary iii. Ensure adequate spontaneous respiration

	4. Observation and monitoring Set up: - i. Blood pressure ii. Pulse oximetry iii. ECG (optional) iv. Respiratory rate v. Clinical observation - Blood loss - Drug reaction - Urine output - Surgical Drain - Dressing site - Level of consciousness - Pain score < 4 - Vital signs stable - Fully recovered from anaesthesia - Ensure the patient's comfort - Minimum duration of the recovery of 30 minutes 5. Discharge i. Assess the patient's condition (refer to anaesthesia form PER-ANAES 301) ii. Confirm fitness for discharge iii. Vital sign stable iv. Ensure that recovery is achieved before discharge v. Give discharge instructions vi. Documentation vii. Handing over to ward staff
References	

	Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Butterworth, J. F. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Patient Safety Unit & Safe Surgery Saves Life Steering Committee. (2018). *Guidelines on Safe Surgery Saves Lives Programme* (2nd ed.). Kuala Lumpur: Ministry of Health Malaysia. Retrieved February 22, 2022, from https://patientsafety.moh.gov.my/v2/?page_id=867 Vimlati, L., Gilsanz, F. & Goldik, Z. (2009). Quality and safety guidelines of postanesthesia care: Working Party on Post Anesthesia Care (approved by the European Board and Section of Anesthesiology, Union Européenne des Médecins Spécialistes). *European Journal of Anesthesiology, 26*(9), 715 - 721. doi:10.1097/EJA.0b013e32832bb68f.
Flow Chart	Refer to Appendix 11
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF POST ANAESTHESIA CARE



PROCEDURE 12 : PERFORM RAPID SEQUENCE INDUCTION AND INTUBATION

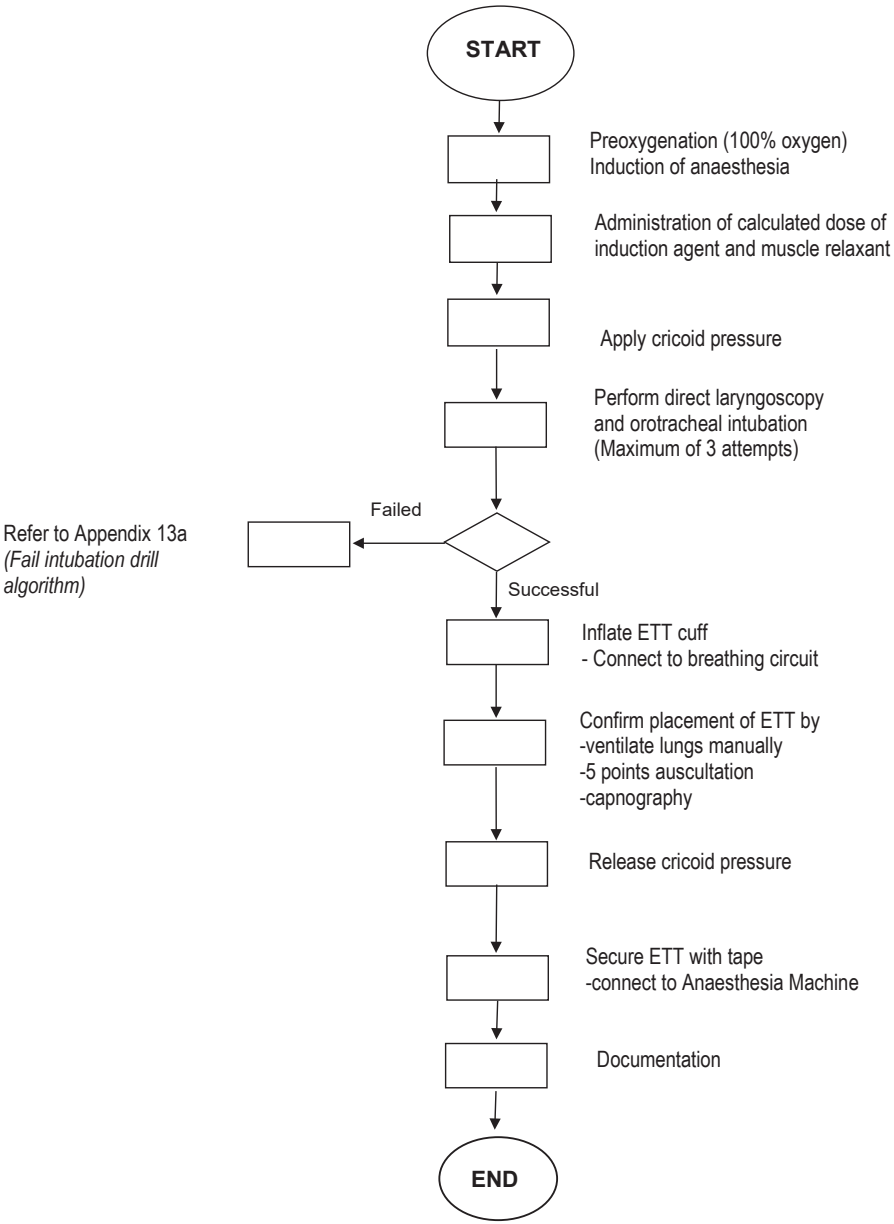
Scope	Anaesthesia Technologist are responsible for performing rapid sequence induction and intubation for patients require general anesthesia in: 1. Emergency surgery and elective with high risk of aspiration 2. Pregnancy for Emergency Lower Segment Caesarean Section (LSCS)
Purpose	Securing the patient's airway to facilitate emergency operations to prevent aspiration.
Materials / Equipment	1. Please refer to procedure no.8 (Endotracheal Intubation) 2. Anaesthesia Machine 3. Physiological monitoring system 4. PPE 5. SSSL form 6. Anaesthesia form PER-ANAES-301 7. Anaesthesia consent 8. High-risk consent (where applicable) 9. Intubation – MALES i. M: - Mask - Medication - Magill forceps ii. A: - Airway (oropharyngeal, nasopharyngeal) iii. L: - Laryngoscope - Lubricant gel iv. E: - ETT - Emergency trolley v. S: - Stylet

	- SGA - Stethoscope. - Suction apparatus • Suction catheter with appropriate size • Yankauer – appropriate size - Syringe: 10ml or 20ml - Securing tape - Scissor 10. Medication (pre-calculated) i. Short-acting opioid: fentanyl (except LSCS) ii. Induction agent: propofol or sodium thiopentone iii. Neuromuscular blocking agent: suxamethonium or rocuronium iv. Pre-treatment: iv lignocaine, atropine 11. Head-ring 12. Adequate IV access 13. Ryle's tube (emptying gastric content)
Work Process	1. Hand hygiene. 2. Wear appropriate PPE. 3. Preparation equipment – as for intubation. 4. Preparation of medication – as above. 5. Preparation of patient: i. Ensure the IV line is patent and functioning. ii. Place the patient in a sniffing position. 6. Monitor hemodynamic parameters continuously. 7. Pre-Oxygenate for 3 – 5 minutes with 100% oxygen i. Ask the patient to breath in and out with 100% O2 through a face mask that is tightly applied to the face ii. Keep the suction machine on and ready for use 8. Induction i. Administration of short-acting anaesthetic agent. - Short acting opioid: fentanyl (except for LSCS) - Induction agent: propofol or sodium thiopentone.

	- Neuromuscular blocking agent: suxamethonium or rocuronium. - Pre-treatment drug – whenever indicated. ii. Apply cricoid pressure (Sellick Maneuver): 20 – 30 Newton as the patient becomes unconscious. 9. Intubation: i. Inflate the ETT cuff (until the leaking sound is disappeared during auscultation or 5 to 10 ml) ii. Remove stylet. iii. Level of ETT – measured at incisor teeth: - Female: 18 – 20cm. - Male: 20 – 22cm. 10. Connect to the breathing circuit 11. Confirmation of ETT placement: i. Visible chest rises ii. Water vapour in ETT iii. Capnograph – normal EtCO2 iv. 5 – points auscultation: equal air entry v. Evaluation of oxygenation via skin signs vi. Chest X-Ray – when applicable 12. Release cricoid pressure once ETT placement has beenconfirmed 13. Secure ETT with securing tape 14. Connect to an anaesthesia machine 15. Continuous monitoring of patients 16. Documentation
References	Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.

	Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Grable, B. &. (2015). Patient Monitoring. In P. K. Sikka, *Basic Clinical Anesthesia* (pp. 70 - 74). New York: Springer. doi:10.1007/978-1-4939-1737-2 Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Williamson, D., & Nolan, J. (2015). Airway assessment. In A. B. Burtenshaw (Ed.), *Emergency Airway Management* (2nd ed., Vol. 41). London: Cambridge University Press.
Flow Chart	Refer to Appendix 12
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF RAPID SEQUENCE INDUCTION & INTUBATION



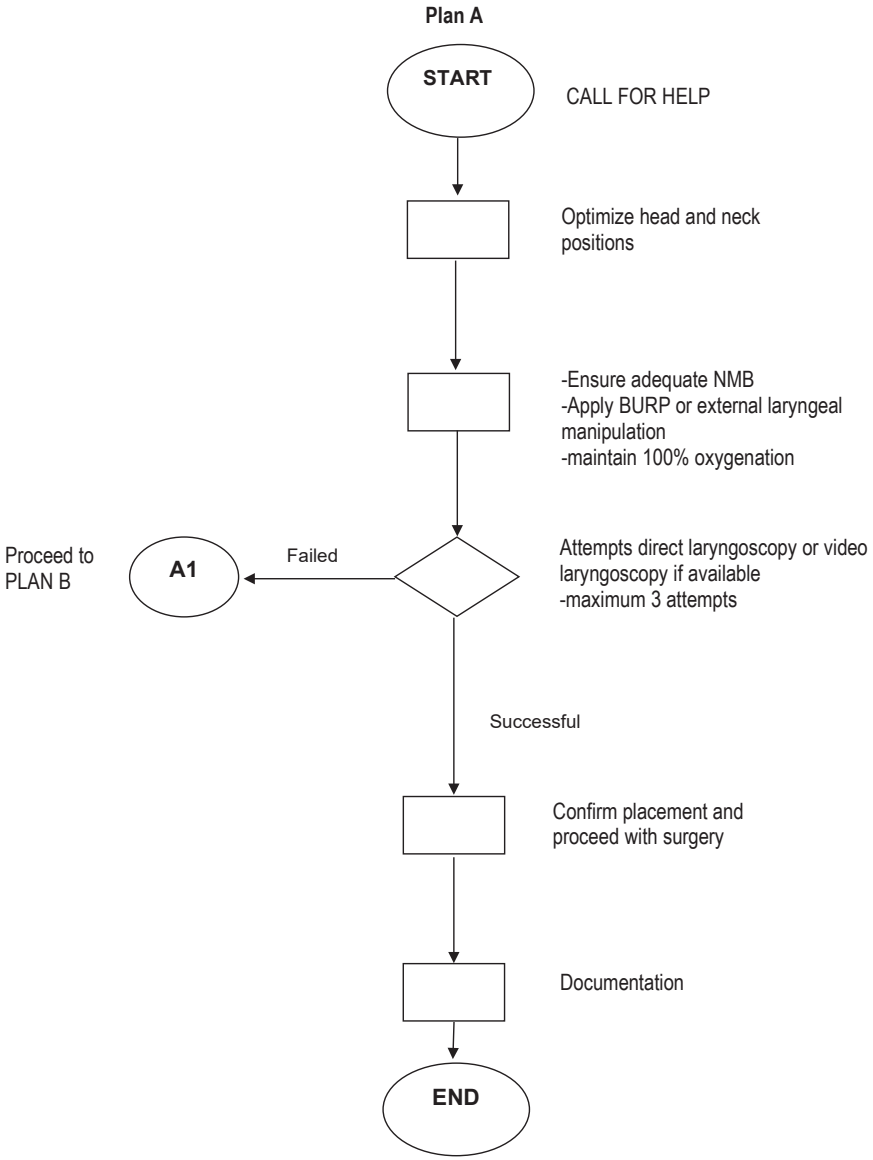
PROCEDURE 13 : FAILED ENDOTRACHEAL INTUBATION DRILL (UNEXPECTED)

Scope	Anaesthesia Technologist are responsible for being able to manage Failed Endotracheal Intubation Drills. (Failure to intubate for 2 – 3 attempts)
Purpose	To secure the airway in the event of failed endotracheal intubation following induction of anaesthesia.
Materials / Equipment	1. Please refer to procedure no. 2 (anaesthetic apparatus) 2. Case note 3. McCoy Laryngoscope set 4. Flexible intubating scope (if available) 5. Video laryngoscope (if available) 6. Oropharyngeal and Nasopharyngeal Airways 7. Supraglottic Airways 8. Bougie 9. Cricothyroidotomy set
Work Process	**Adapted from Difficult Airway Society (DAS) algorithm 2015** 1. Call for help! 2. **PLAN A (Face mask ventilation and tracheal intubation)** i. Optimize head and neck position ii. Maintenance of airway and ventilation - Maintain ventilation with 100% oxygen - Maintain cricoid pressure (if rapid sequence induction) iii. Ensure adequate NMB iv. Attempt direct or video laryngoscopy (if available) v. Maximum 3 attempts vi. Apply BURP technique or external laryngeal manipulation vii. If successful intubation confirm placement of ETT with capnography and five points auscultation

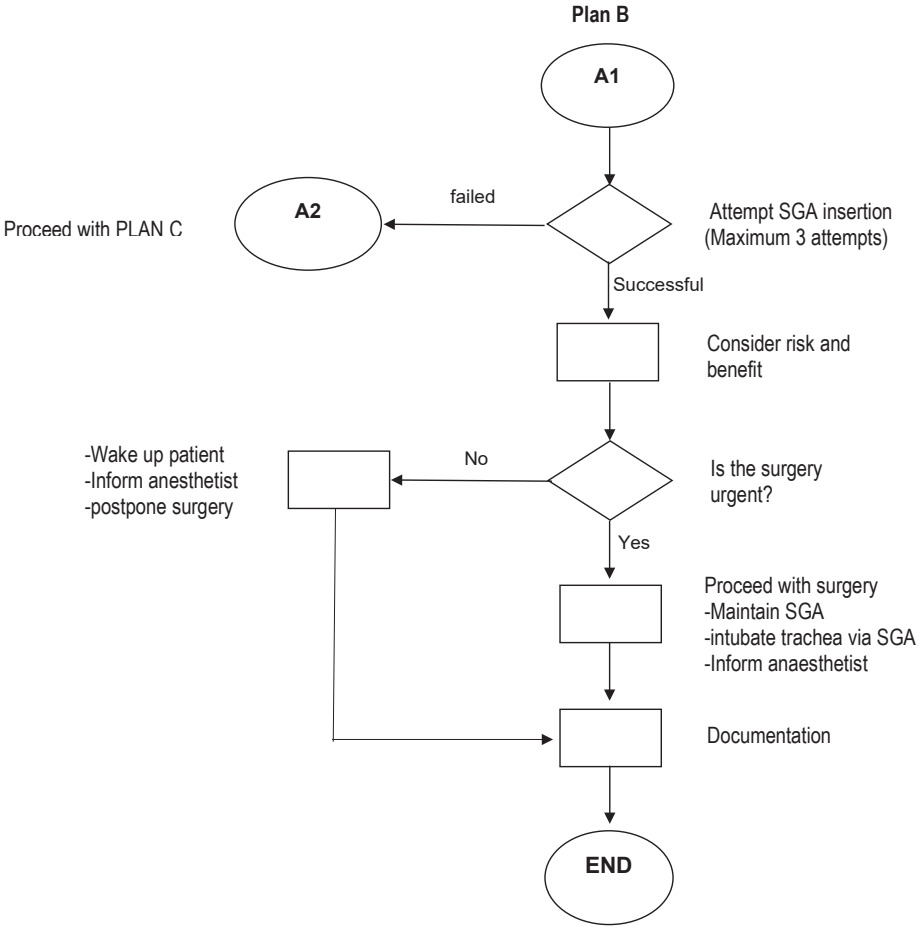
	viii. If failed to intubate proceed to plan B 3. **PLAN B (maintaining of oxygenation with SGA insertion)** i. Maintain oxygenation ii. Attempt SGA insertion - maximum 3 attempts iii. If successful consider risk and benefit of proceeding with the anaesthesia iv. Options to consider - Wake-up patient if surgery is not urgent - Consider passing ETT through SGA - Consider proceeding with SGA if surgery is urgent v. If failed SGA insertion proceed to Plan C 4. **PLAN C (face mask ventilation)** i. Maintain oxygenation with face mask ii. If able to ventilate wake up patient iii. If difficult to ventilate use 2-person technique and declare "can't ventilate can't intubate" 5. **PLAN D ("can't ventilate can't intubate")** i. emergency front of neck access (eg cricothyroidotomy or tracheostomy)
References	Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Grable, B. &. (2015). Patient Monitoring. In P. K. Sikka, *Basic Clinical Anesthesia* (pp. 70 - 74). New York: Springer. doi:10.1007/978-1-4939-1737-2 Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Williamson, D., & Nolan, J. (2015). Airway assessment. In A. B.

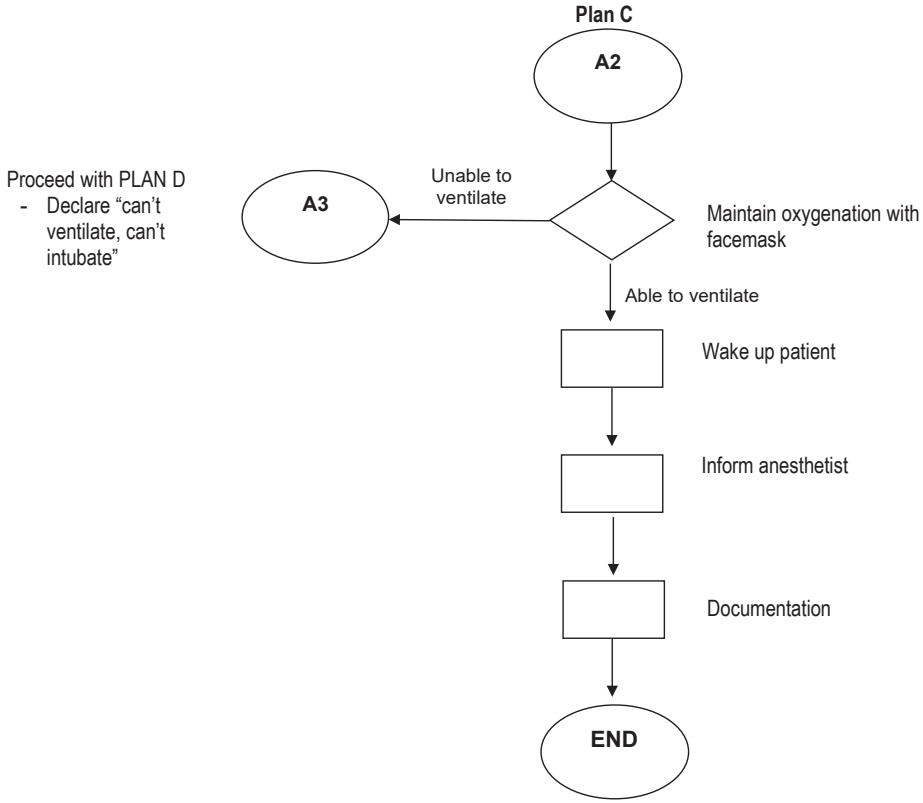
	Burtenshaw (Ed.), *Emergency Airway Management* (2nd ed., Vol. 41). London: Cambridge University Press.
Flow Chart	Refer to Appendix 13a – 13d
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART: FAILED ENDOTRACHEAL INTUBATION DRILL

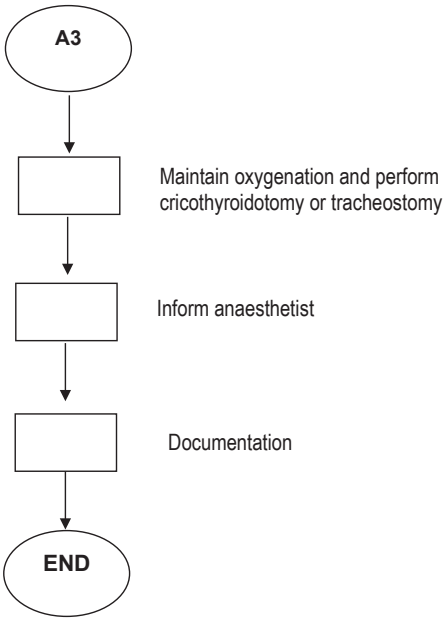


Appendix 13b




Plan C
A2
Unable to ventilate
A3
Proceed with PLAN D
- Declare "can't ventilate, can't intubate"
Maintain oxygenation with facemask
Able to ventilate
Wake up patient
Inform anesthetist
Documentation
END

Plan D (Declare “can’t ventilate, can’t intubate”**)**



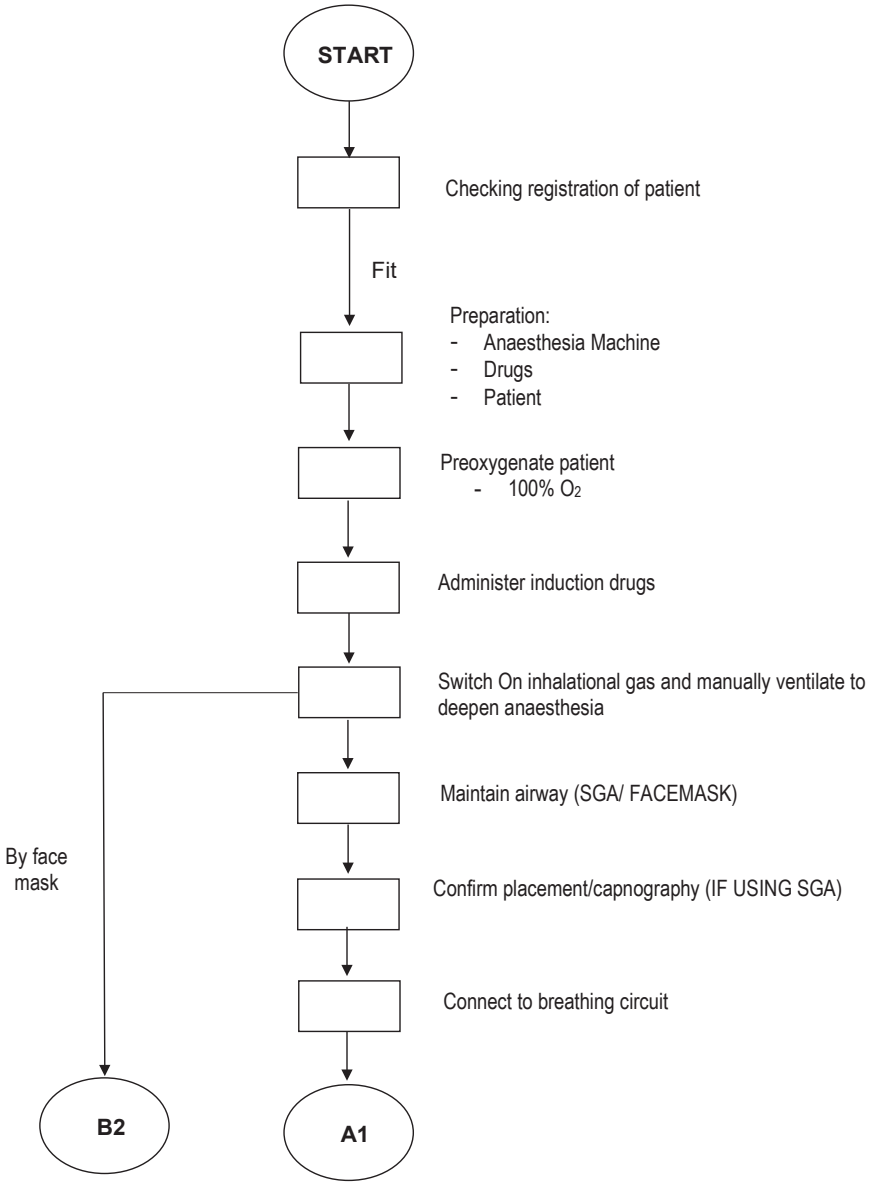
PROCEDURE 14 : MAINTENANCE OF GENERAL ANAESTHESIA (SPONTANEOUS)

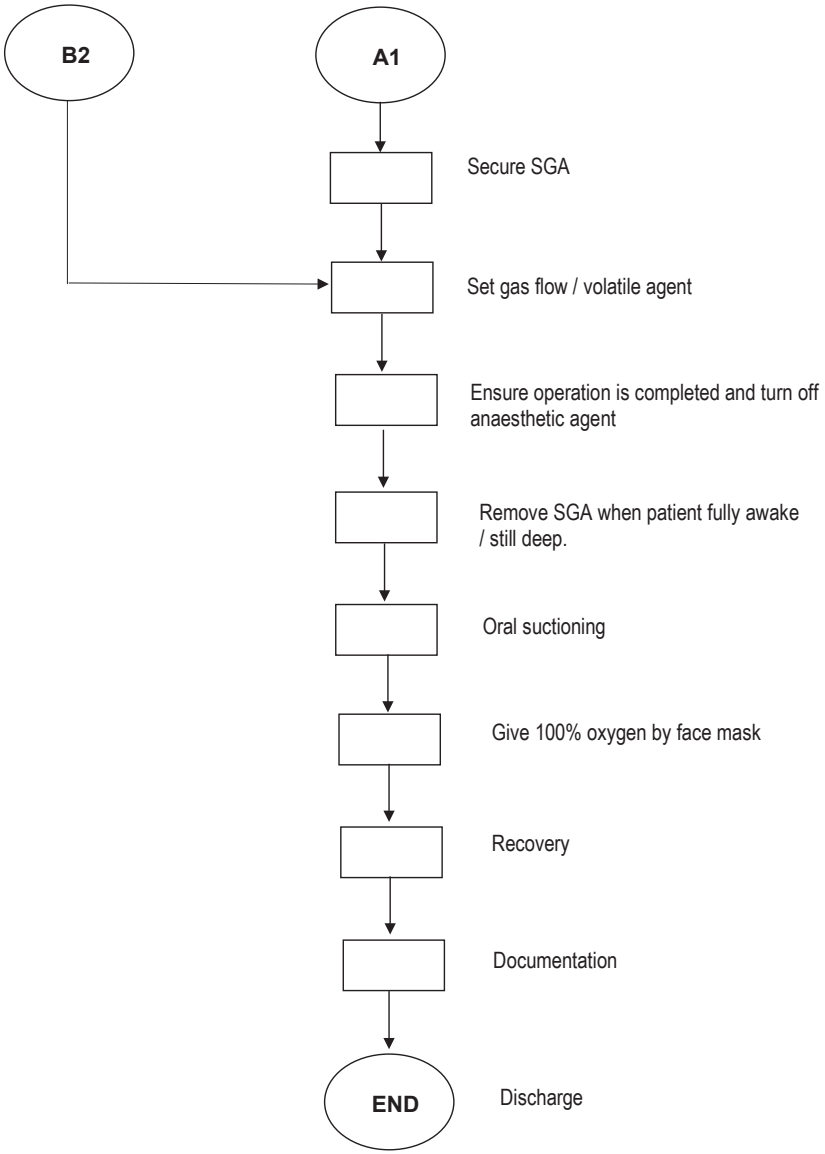
Scope	Anaesthesia Technologist is responsible for maintaining general anaesthesia (spontaneous) for patients undergoing surgical procedures.
Purpose	Provide balance, effective and safe delivery of General Anaesthesia during the procedure to facilitate surgical intervention without the use of muscle relaxant.
Materials / Equipment	Refer to procedure no.2
Work Process	1. Final assessment 2. Final checking and preparation of the anaesthesia machine 3. Preparation of anaesthetic drugs 4. Preparation of patient 5. Induction i. Pre-oxygenate the patient for 3 to 5 minutes ii. Ensure SpO2 98-100% iii. Induce the patient to sleep iv. Analgesic/opioid - Fentanyl 1 - 2 mcg/kg v. Induction agent: - Drugs of choice: • IV Propofol 2-3 mg/kg • IV Ketamine 2mg/kg vi. Test for airway patency vii. Administer Air / Nitrous Oxide and Volatile Agent 6. Maintain airway either through: i. Face mask ii. Supraglottic device: (e.g. LMA, Proseal / I-gel / Baska / Supreme / Ambu) iii. Insert Supraglottic airway when patient is fully anaesthetized iv. Connect all airway adjunct to breathing circuit v. Confirm correct placement by capnography vi. Secure airway

	7. Maintenance of anaesthesia i. Set gas flow and vaporizer ii. Monitor - Vital signs - Ventilation - Depth of anaesthesia - Adequate analgesia iii. Prevent Hypothermia: - Temperature probe - Warming devices - Warmed IV fluids 8. Termination of anaesthesia i. Turn off all anaesthetic agents ii. Administer 100 % oxygen iii. Remove SGA when patient is fully conscious. Consider deep extubation if indicated. iv. Oral suction to clear secretions v. Give 100 % oxygen via mask until patient fully recover 9. Recovery (to refer Recovery flow chart)
References	Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Grable, B. &. (2015). Patient Monitoring. In P. K. Sikka, *Basic Clinical Anesthesia* (pp. 70 - 74). New York: Springer. doi:10.1007/978-1-4939-1737-2 Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Williamson, D., & Nolan, J. (2015). Airway assessment. In A. B. Burtenshaw (Ed.), *Emergency Airway Management* (2nd ed., Vol.

	41). London: Cambridge University Press.
Flow Chart	Refer to Appendix 14
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF MAINTENANCE OF GENERAL ANAESTHESIA (SPONTANEOUS)




B2
A1
Secure SGA
Set gas flow / volatile agent
Ensure operation is completed and turn off anaesthetic agent
Remove SGA when patient fully awake / still deep.
Oral suctioning
Give 100% oxygen by face mask
Recovery
Documentation
END
Discharge

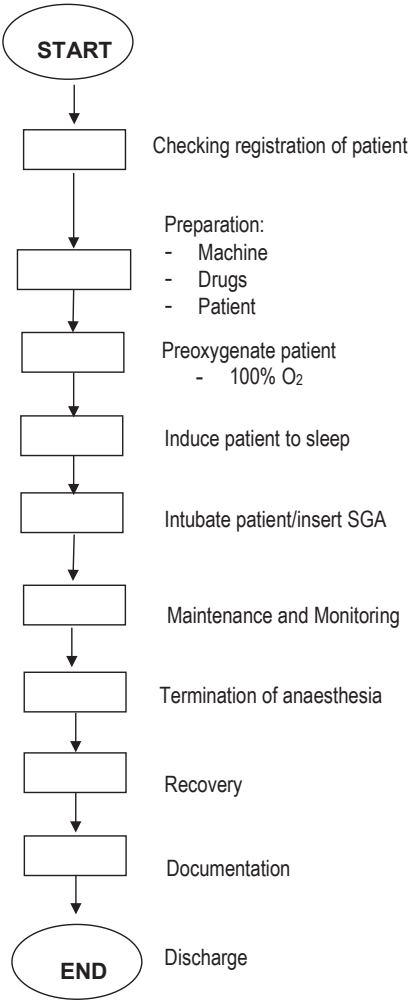
PROCEDURE 15 : ADMINISTRATION OF TOTAL INTRAVENOUS ANAESTHESIA (TIVA)

Scope	Anaesthesia Technologist is responsible to perform/assist in the administration of Total Intravenous Anaesthesia (TIVA) as indicated for patients undergoing surgical procedures such as: 1. Neurosurgical procedure 2. Use of neurophysiological monitoring to facilitate surgery (e.g., spine surgery) 3. Oocyte retrieval 4. MH susceptible patients 5. Bronchoscopy/ENT-laser surgery 6. Ambulatory surgery 7. Patients at risk of post-operative nausea and vomiting 8. Procedural sedation and monitored anaesthesia care
Purpose	Propofol-based intravenous anaesthesia with short acting opioids provide rapid, balanced, effective and safe delivery of General Anaesthesia (TIVA) to facilitate surgical intervention and predictable, rapid recovery of consciousness and psychomotor function with enhanced recovery after surgery.
Materials / Equipment	1. PPE 2. Anaesthesia Machine 3. TIVA pump (TCI) 4. BIS monitoring (if NMB used) 5. Physiological monitoring system i. ECG ii. SpO2 iii. Blood Pressure iv. Capnograph v. Oxygen 6. Face masks & venturi masks 7. Oropharyngeal airways 8. Laryngeal mask airways (LMA) 9. Endotracheal tube (various sizes)

	10. Other new airway adjuncts 11. Suction machine 12. The suction catheter or Yankauer 13. Laryngoscopes (with blades of various sizes) 14. Stylet/bougie 15. Resuscitation facilities 16. Anaesthetic Cart / Medication Trolley 17. Anaesthetic Form (PER-ANAES-301) 18. Radiant Warmer & Warming apparatus
Work Process	Pre-oxygenation and induction of anaesthesia 1. Pre-oxygenate, induce anaesthesia with TCI and maintain the airway. 2. Maintenance of anesthesia with TCI. Ensure adequate level of anesthesia but avoid over-depressing the cardiovascular system. 3. Continue Intravenous infusion of anaesthesia until the procedure is completed. Ensure adequate analgesia/reflex suppression, hemodynamic stability, and muscle relaxation. 4. Spontaneous breathing or mechanical ventilation (IPPV) depends on type of procedure. 5. Maintain normal physiological body functions 6. Termination of anaesthesia. i. Turn off all anaesthetic agents ii. Administer 100 % oxygen iii. Oral suctioning to clear all secretions at appropriate time iv. Give 100 % oxygen via mask 7. Recovery i. Transfer patient to recovery room when the patient condition is stable. ii. Monitor patient closely iii. Ensure the anaesthetic record is completed 8. Documentation (Anaesthetic form PER-ANAES-301)

	9. Discharge i. Assess the patient's condition ii. Confirm fitness for discharge iii. Give discharge Instruction
References	Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.* New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). New York: McGraw Hill Education. Davies, C., Katyayani, K., Kunst, G., Taylor, C. C. , Wang, Y., Barber, S. & Milan, Z. (2019). Comparing Bispectral Index and Narcotrend monitors in patients undergoing major hepatobiliary surgery: a case series. *Clinical Audit, 11*, 17 - 25. doi:https://doi.org/10.2147/CA.S183400 Kelly, S. D. (2007). *Monitoring Counsciousness: Using the Bispectral Index During Anesthesia, A Pocket Guide for Clinicians.* (2. edition, Ed.) USA. Retrieved March 30, 2022, from https://www.uoflhealthnetwork.org/documents/Nursing/BIS%20Pocket%20Guide.pdf Lee, C. Y. (2006). *Manual of anesthesia.* Singapore: McGraw Hill Education. Lim T. A. et al., (2015). Total Intravenous Anesthesia: Using target control infusion, A pocket reference. (3rd edition) College of Anesthesiologist, Academy of Medicine of Malaysia.
Flow Chart	Refer to Appendix 15
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF ADMINISTRATION OF TOTAL INTRAVENOUS ANAESTHESIA (TIVA)



PROCEDURE 16 : ADMINISTRATION OF MONITORED SEDATION

Scope	Anaesthesia Technologist is responsible for administering and managing monitored sedation for patients undergoing minor surgical procedures, painful treatment, and endoscopic procedures (ASA I & II)
Purpose	Provide effective and safe sedation delivery to ensure the patient is fully sedated and pain-free during procedures
Materials / Equipment	1. Anaesthesia Machine 2. Physiological monitoring system 3. Resuscitation facilities / drugs 4. Airway management devices 5. Syringes (various sizes) 6. Drawing needles 7. Injection needles 8. IV drip sets 9. IV cannula (various sizes) 10. IV solutions: i. Normal saline ii. Hartmann's iii. Dextrose Saline 11. Drip stand 12. Plasters 13. Disposable gloves 14. Head-ring / pillow 15. Drugs labels 16. Drugs: i. Sedative ii. Analgesic / Opioids

	iii. Benzodiazepine iv. Flumazenil 17. Anaesthetic Form (PER-ANAES-301) 18. Warming devices 19. Suction apparatus
Work Process	1. Final assessment 2. Final checking and preparation of anaesthesia machine *(Refer to procedure no.1)* 3. Preparation of drugs and intravenous drip i. Dilute and label intravenous drugs of choice. ii. Dosage of sedation depends on clinical condition of patient and type of surgery - Opioids: • Fentanyl 1 - 2 mcg / kg • Morphine 0.1 - 0.2 mg/kg • Pethidine 1 – 2 mg / kg - Benzodiazepine: (in titrated dosage) • Midazolam 0.02 – 0.1 mg / kg - Hypnotic drugs: • Propofol 10mg - intermittent dose or as infusion 6mg - 10mg/kg/hr • Remifentanil 0.1 – 0.5mcg/kg/min • Ketamine 1-2 mg/kg • Precedex (if available) 4. Preparation of patient i. Introduction and explanation: - - Introduce yourself to patient - Explain and inform procedure to patient - Briefly explain to patient effect of sedation

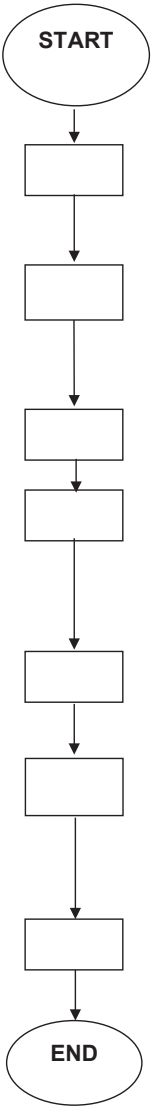
	ii. Position patient according to need iii. Establish intravenous access - Normal saline 0.9% - Hartman's solution iv. Check and record baseline vital signs 5. Monitoring i. Set up monitoring device and record all baseline data into anesthesia form - Continuous vital signs monitoring: • ECG • Blood pressure • SpO2 • Respiratory Rate / Capnograph 6. Sedate patient i. Administer sedation as indicated ii. Choices of drugs and dosage to be administered as indicated - Type of drugs and dosage must be labelled - To document any intra-operative event encountered. 7. Assess level of sedation i. Assess sedation score ii. Maintain verbal communication to detect signs of over sedation iii. Clinical observation iv. Vital signs monitoring v. Patient relaxed and sedated. Absence of: - - Pain - Breathlessness - Flushing - Pallor

	- Sweating - Vomiting 8. Oxygenation Give oxygen to avoid desaturation, especially in endoscopic procedures i. Continuous vital signs monitoring ii. Administer Oxygen via Face mask / nasal catheter 9. Recovery i. Transfer the patient to the recovery room when the patient's condition is stable ii. Monitor the patient closely. iii. Ensure the anaesthetic record is completed iv. Evaluate the patient's condition v. Support airway if required vi. Oral suctioning when necessary vii. Assess the patient's condition - Ensure the anaesthetic record is completed - Continuous vital signs monitoring - Oxygen supply - Venturi mask / Nasal prong - Observation not less than 30 mins 10. Discharge i. Confirm the patient's fitness ii. Give discharge instructions iii. Discharge to respective ward iv. Confirm fitness for discharge based on satisfactory recovery score (6/6)
References	Practice Guidelines for Moderate Procedural Sedation and Analgesia. (2018). A Report by the American Society of Anesthesiologists Task Force on Moderate Procedural Sedation and Analgesia, the American Association of Oral and Maxillofacial

	Surgeons, American College of Radiology, American Dental Association, American Society of Dentist Anesthesiologists, and Society of Interventional Radiology. Standard Operating Procedures for Assistant Medical Officer in Anesthesiology. (2007). Kementerian Kesihatan Malaysia. Standard Operating Procedures for Assistant Medical Officer in Anesthesiology. (2022). Kementerian Kesihatan Malaysia.
Flow Chart	Refer to Appendix 16
Revision History	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

Appendix 16

FLOW CHART OF ADMINISTRATION OF MONITORED SEDATION



Checking / registration

Preparation
- Anaesthesia Machine
- Airway management devices
- Drug
- Patient

Administer sedation

Assess level of sedation
- Clinical observation
- Physiological observation
- Verbal communication

Oxygenation / Maintain airway

Reassess patient
- Vital signs
- Patent air way
- Patient comfort

Transfer to recovery and do documentation

Discharge

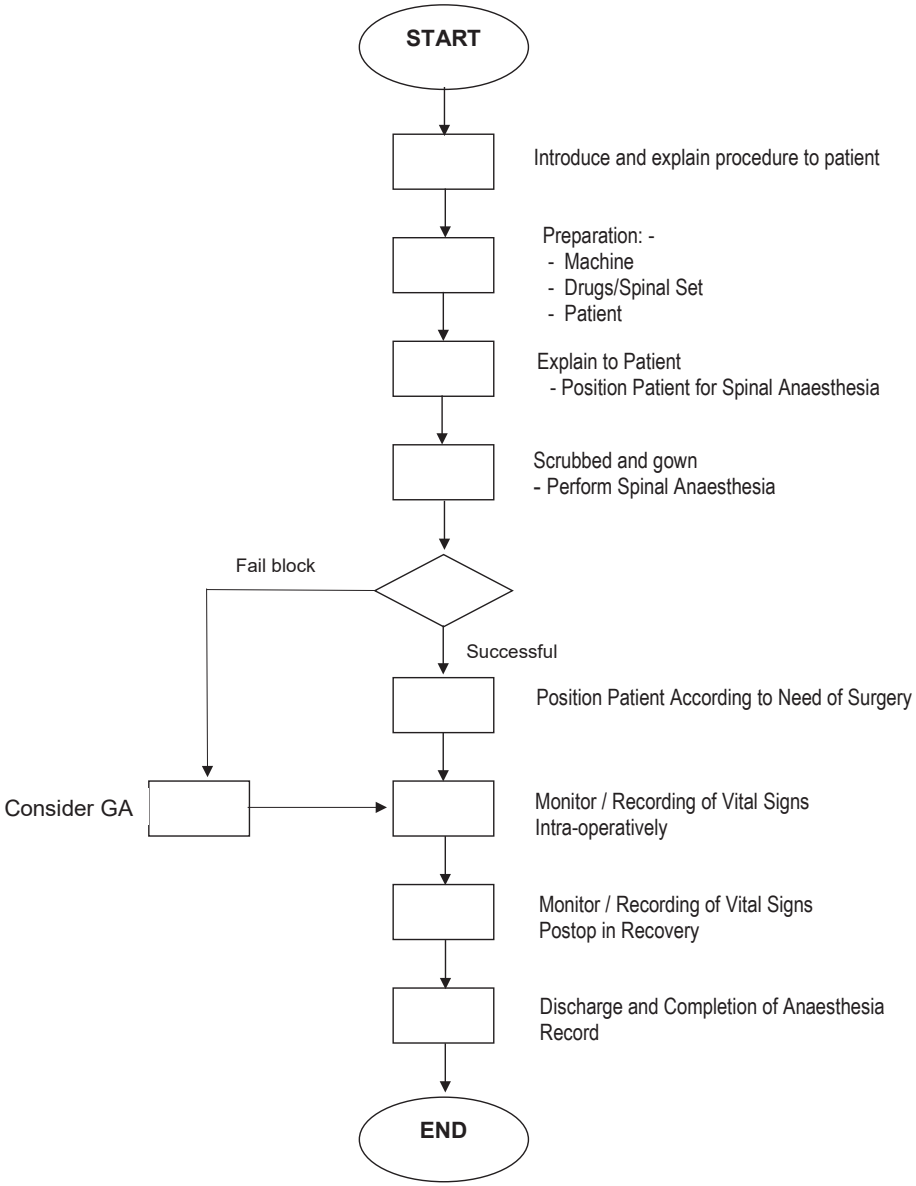
PROCEDURE 17 : SPINAL ANAESTHESIA

Scope	Anaesthesia Technologist is responsible for performing Spinal Anaesthesia
Purpose	To provide anaesthesia for lower abdominal or lower limb surgery
Materials / Equipment	1. Anaesthesia Machine 2. Anaesthetic consent form (endorsed by Medical Officer) 3. PPE 4. SSSL 5. Anaesthetic form (PER-ANAES-301) 6. Spinal Trolley 7. Spinal set 8. Spinal needles – pencil point or cutting tip (25G or 27G). 9. Drug: i. Local anaesthetic drugs: Heavy Marcaine 0.5% and lignocaine 2% 10. Opioids: Morphine, Fentanyl 11. Syringe 1ml, 3mls (luer-lock) and 5mls 12. Needles (23G / 21G) 13. Sterile gown and gloves 14. Pillow 15. Sterile hole towel 16. Green gauze 17. Chlorhexidine 0.5% solution in 70 % alcohol 18. Superficial wound dressing spray (E.g. Opsite spray) 19. Ice/spirit swab for cold/warm 20. Resuscitation items 21. Warming devices
Work Process	1. Introduce yourself to a patient, explain and inform the procedure to the patient

2. Monitor vital signs (take baseline B/P, SPO2, HR, RR)
3. Prepare drugs (atropine, ephedrine or phenylephrine and propofol)
4. IV line available and functioning well
5. Position patient
6. Open the spinal set after scrubbed and gown
7. Clean and drape the patient under an aseptic technique
8. Identify injection site
9. Infiltrate skin with lignocaine 2%
10. Insert spinal needle slowly with bevel pointing cephalad until dura is punctured (loss of resistance is felt)
    i. Withdraw stylet and observe the free flow of cerebrospinal fluid (CSF) – clear
    ii. If CSF flow is not good, adjust the depth of the needle (slightly straight in or out)
    iii. Attach a syringe containing heavy bupivacaine 0.5% and administer the dose required
        - Remove needle out completely and apply sterile dressing over the injection site
        - Test for the effectiveness of spinal anaesthesia and level of block:
            - Unable to lift legs
            - No cold sensation to lower limbs
            - Numbness and tingling sensation to legs
11. Upon satisfactory spinal anaesthesia blockade, proceed with surgery
    i. Give oxygen via face mask 5L/m or nasal prong 2L/m
    ii. Monitor the patient's vital signs every 5 minutes
    iii. Watch out for hypotension and the sign of high spinal
    iv. Monitor conscious level
    v. Monitor respiration rate

	vi. Position patient according to surgery 12. If spinal anaesthesia fails, consider converting to general anaesthesia if not contraindicated. 13. Recovery i. Handover to recovery staff ii. Supine position iii. Give oxygen (optional) iv. Continuous monitoring 14. Discharge i. Evaluate the patient's condition ii. Confirm fitness for discharge. iii. Assess bromage score iv. Give discharge instructions 15. Documentation
References	Salinas. F. (2005). In Essentials of Pain Medicine and Regional Anesthesia 2nd edition. Standard Operating Procedures for Assistant Medical Officer in Anesthesiology. (2007). Kementerian Kesihatan Malaysia. Standard Operating Procedures for Assistant Medical Officer in Anesthesiology. (2022). Kementerian Kesihatan Malaysia.
Flow Chart	Refer to Appendix 17
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF SPINAL ANAESTHESIA



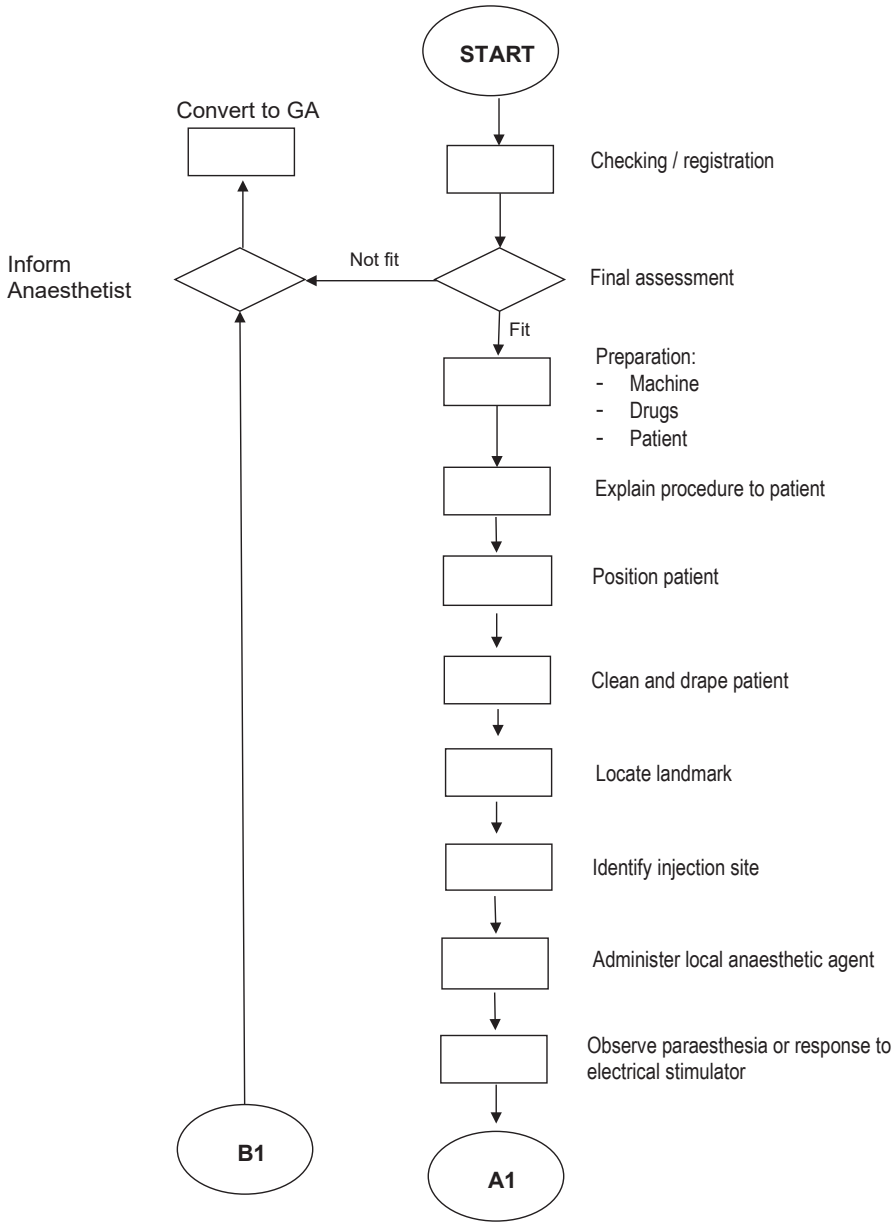
PROCEDURE 18 : PERIPHERAL NERVE BLOCK

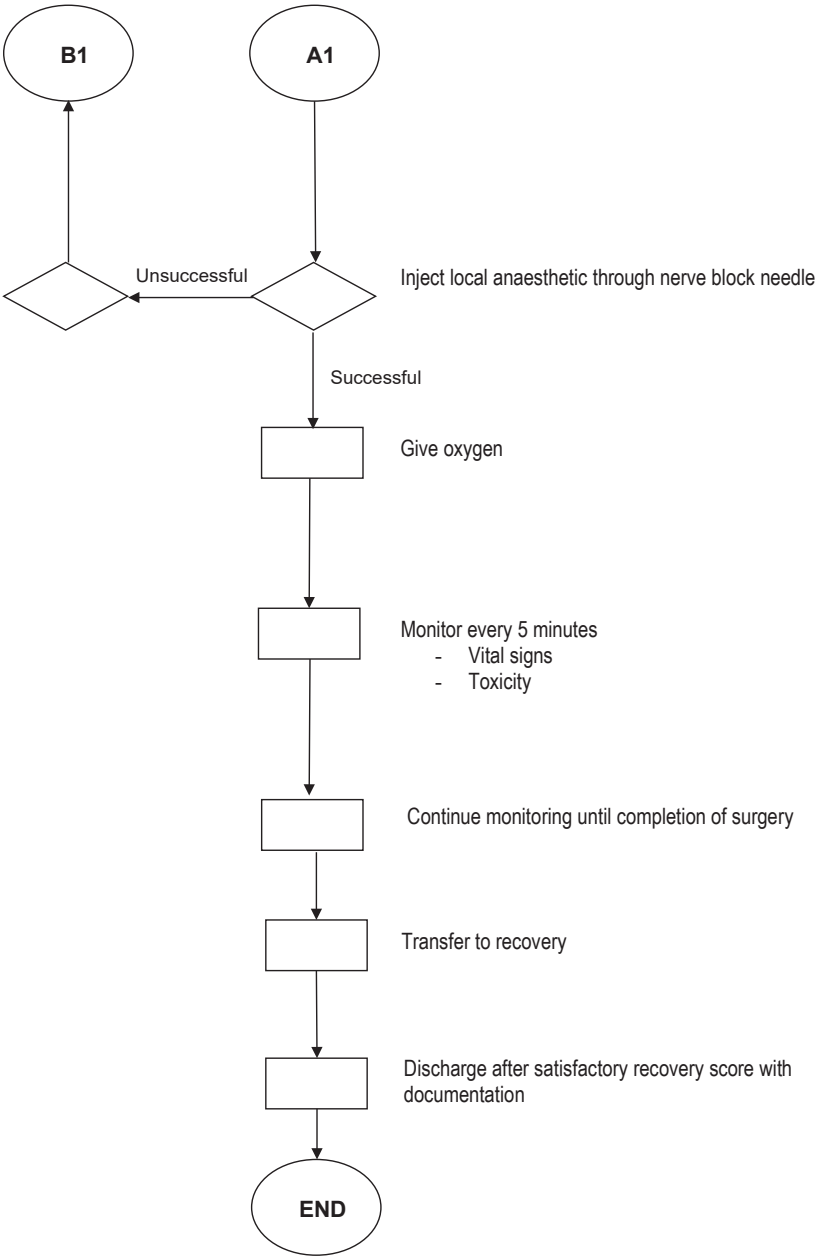
Scope	Anaesthesia Technologist may perform simple blocks such as ankle, digital, wrist and penile blocks as an option for general anaesthesia technique.
Purpose	Provide adequate analgesia for minor Surgery (hand and foot)
Materials / Equipment	1. Physiological monitors 2. Resuscitation drugs 3. Induction drugs (if required) 4. Muscle relaxants (if required) 5. Drug labels 6. Sterile hole towel 7. Sandbag (optional) 8. Chlorhexidine 2 % solution in 70% alcohol 9. Vent mask or nasal prong 10. Anaesthetic Cart / Medication Trolley 11. Warming apparatus 12. Anaesthetic form (PER-ANAES-301) 13. Drugs: i. Local anaesthetic drugs: Bupivacaine, Ropivacaine, Levobupivacaine and lignocaine 2% ii. Opioids: Morphine, Fentanyl iii. Intubation drugs: Hypnotic agent (propofol/Thiopentone), NMBA iv. Anticholinergic agent: Atropine v. Antisialagogue agent: Glycopyrrolate vi. Emergency drugs: Adrenaline 14. Basic Procedure Pack
Work Process	1. Wear appropriate PPE

	2. Final assessment – Refer to the relevant procedure 3. Preparation of equipment and drugs i. Prepare drugs ii. Basic Procedure Pack 4. Perform peripheral nerve block i. Explain the procedure to the patient ii. Positioning of the patient iii. Clean and drape the patient under an aseptic technique iv. Identify injection site v. Administer local anaesthetic agent 5. Maintenance and monitoring i. Administer oxygen therapy whenever indicated ii. Observe for signs of toxicity iii. Adequate spontaneous breathing iv. Vital signs monitoring v. Abnormal involuntary movements 6. Recovery i. Handover to recovery staff ii. Supine position iii. Give oxygen (optional) iv. Continuous monitoring 7. Discharge i. Evaluate the patient's condition ii. Confirm fitness for discharge iii. Give discharge instructions 8. Documentation
References	Lo, N., Brull, R., Perlas, A., Chan, V. W., McCartney, C. J., Sacco, R., & El-Beheiry, H. (2008). Evolution of ultrasound guided axillary brachial plexus blockade: retrospective

	analysis 0f 662 blocks. Canadian journal of anaesthesia = Journal canadien d'anesthesia, 55(7), 408-413. https://doi.org/10.1007/BF03016306 Standard Operating Procedures for Assistant Medical Officer in Anaesthesiology. (2007). Kementerian Kesihatan Malaysia. Standard Operating Procedures for Assistant Medical Officer in Anaesthesiology. (2022). Kementerian Kesihatan Malaysia. Stav, A., Reytman, L., Stav, M. Y., Portnoy, I., Kantarovsky, A., Galili, O., Luboshitz, S., Sevi, R., & Sternberg, A. (2016). Comparison of the Supraclavicular, Infraclavicular and Axillary Approaches for Ultrasound-Guided Brachial Plexus Block for Surgical Anesthesia. Ramban Maimonides medical journal, 7(2), e0013. https://doi.org/10.5041/RMMJ.10240 Lee, C. Y. (2006). *Manual of anaesthesia.* Singapore: McGraw Hill Education. Larry F. C.& Andrea J.F. (2012). *Manual of Clinical Anaesthesiology.*
Flow Chart	Refer to Appendix 18
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anaesthesiology MOH (2007)

FLOW CHART OF PERIPHERAL NERVE BLOCK




B1
A1
Unsuccessful
Inject local anaesthetic through nerve block needle
Successful
Give oxygen
Monitor every 5 minutes
- Vital signs
- Toxicity
Continue monitoring until completion of surgery
Transfer to recovery
Discharge after satisfactory recovery score with documentation
END

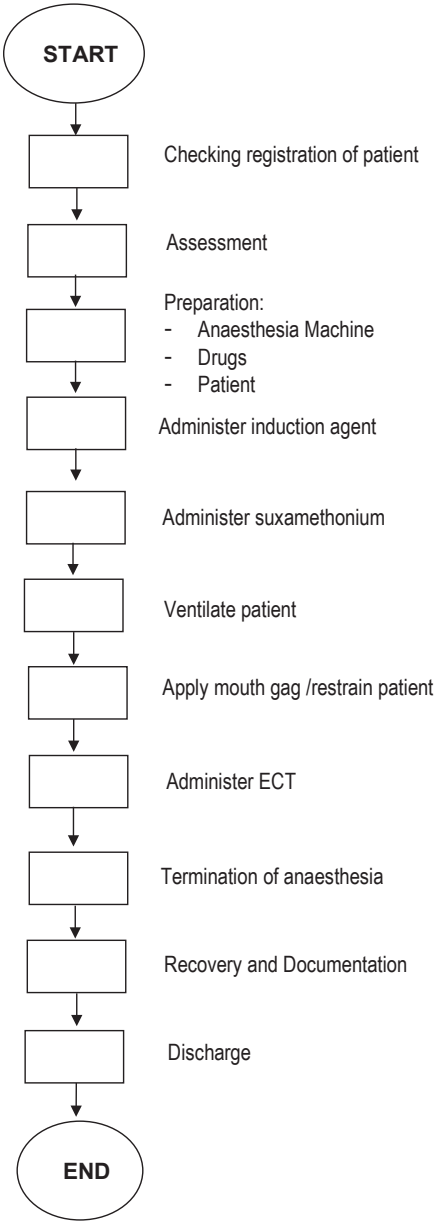
PROCEDURE 19 : ADMINISTRATION OF ANAESTHESIA FOR ELECTROCONVULSIVE THERAPY (ECT)

Scope	Anaesthesia Technologist is responsible for administering anaesthesia to patients undergoing electroconvulsive therapy (ECT)
Purpose	Provide effective and safe anaesthesia delivery to patients undergoing electroconvulsive therapy (ECT) to treat endogenous depression, acute schizophrenic states (not chronic) and manic disorder.
Materials / Equipment	1. Anaesthesia Machine 2. Physiological monitoring system 3. Face masks 4. Oropharyngeal airways 5. Suction apparatus 6. Anaesthetic Cart / Medication Trolley 7. Resuscitation equipment / Defibrillator 8. Mouth gag 9. Warming devices 10. Supraglottic Airways (if required) 11. Anaesthetic Form (PER-ANAES-301)
Work Process	1. Final assessment 2. Final checking and preparation of the anaesthesia machine 3. Preparation of anaesthetic drugs 4. Preparation of patient 5. Monitor and record vital signs every 5 minutes i. ECG ii. Blood pressure iii. Pulse rate iv. SpO2

	v. Capnograph vi. Record vital signs findings in an Anesthetic form 6. Induction i. Administer induction drugs of choice ii. Propofol 0.75 - 1 mg /kg iii. Administer muscle relaxant - Suxamethonium 0.25 - 0.5 mg/kg (sub-paralyzing dose) iv. Gently ventilate the patient with 100% oxygen until fasciculation is over. v. Apply mouth gag vi. Allow the psychiatrist / medical officer to apply an electrical stimulus vii. Monitor vital signs. Watch out for bradycardia. 7. Post ECT observation i. Remove mouth gag ii. Oral suctioning when necessary iii. Insert oropharyngeal airway if necessary iv. Gently ventilate the patient with 100% oxygen via bag and mask until adequate spontaneous respiration returns 8. Recovery i. Transfer the patient to the recovery room when the patient's condition is stable ii. Monitor the patient closely. iii. Ensure the anaesthetic record is completed iv. Evaluate the patient's condition v. Support airway if required vi. Oral suctioning when necessary vii. Observation not less than 30 mins 9. Documentation 10. Discharge (Confirm fitness for discharge based on satisfactory recovery score 6/6)

Reference	Guidelines on Electroconvulsive Therapy. (2021). Medical Development Division. Ministry of Health Malaysia. Standard Operating Procedures for Assistant Medical Officer in Anesthesiology. (2007). Kementerian Kesihatan Malaysia. Standard Operating Procedures for Assistant Medical Officer in Anesthesiology. (2022). Kementerian Kesihatan Malaysia. Uppal, V., Dourish, J., & Macfarlane, A. (2010). Anesthesia for electroconvulsive therapy, *Continuing Education in Anesthesia Critical Care & Pain*, *10*(6), 192–196. https://doi.org/10.1093/bjaceaccp/mkq039
Flow Chart	Refer to Appendix 19
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF ADMINISTRATION OF ANAESTHESIA FOR ELECTROCONVULSIVE THERAPY (ECT)



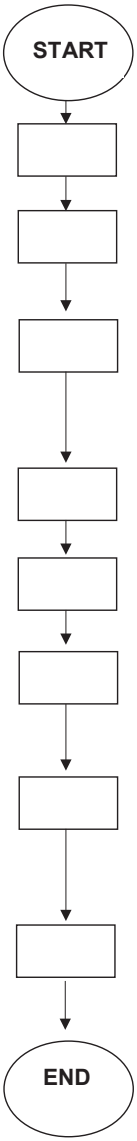
PROCEDURE 20 : MANAGEMENT OF PATIENT IN NON- OPERATING ROOM ANAESTHESIA (NORA)

Scope	Anaesthesia Technologist is responsible for assessing, preparingand assisting anaesthetists in NORA such as MRI suite, CT-scan, ICL, bronchoscopy, endoscopy, urology, angiogram suite and brachy suite
Purpose	To provide anaesthesia outside the operating room to patients undergoing painful or uncomfortable procedures
Materials / Equipment	1. PPE 2. Anaesthesia consent 3. Procedure consent 4. Intubation trolley 5. Suction devices 6. IV cannulation set 7. Physiological monitoring device 8. Anaesthesia machine 9. Emergency trolley 10. Fluid management system (syringe, volumetric pump) *** For MRI suite: equipment must be MRI-safe and compatible**
Work Process	1. Preparation (personnel) i. Hand hygiene ii. Wear an appropriate PPE iii. Ensure personnel adhere to MRI suite protocol - prepare equipment for MRI procedure - check anaesthetic equipment before the conduct of anaesthesia for MRI 2. Preparation of patient: Refer to the relevant checklist according to the primary team 3. Continue monitoring the patient's hemodynamic status. 4. Ensure IV access is functioning.

	5. Assisting in the extubation (in MRI cases- extubation in the recovery unit. 6. Recovery - Handover to recovery staff - Supine position - Give oxygen (optional) - Continuous monitoring 7. Discharge - Evaluate the patient's condition - Confirm fitness for discharge. - Give discharge instructions 8. Documentation
Reference	Uppal, V., Dourish, J., & Macfarlane, A. (2010). Anesthesia for electroconvulsive therapy, *Continuing Education in Anesthesia Critical Care & Pain*, *10*(6), 192–196. https://doi.org/10.1093/bjaceaccp/mkq039 Baheti, K. B. & Laheri, V. V. (2015). *Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach.*New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Butterworth, J. F., Mackey, D. C. & Wasnick, J. D. (2018). *Morgan & Mikhail's Clinical Anesthesiology* (6th ed.). NewYork: McGraw Hill Education. Lee, C. Y. (2006). *Manual of anaesthesia.* Singapore: McGrawHill Education. Patel, S. & Reddy, U. (2016). Anaesthesia for interventional neuroradiology. *British Journal Anaesthesia Education, 16*(5), 147-152. doi:https://doi.org/10.1093/bjaed/mkv032

	Patient Safety Unit & Safe Surgery Saves Life Steering Committee. (2018). *Guidelines on Safe Surgery Saves Lives Programme* (2nd ed.). Kuala Lumpur: Ministry of Health Malaysia. Retrieved February 22, 2022, from https://patientsafety.moh.gov.my/v2/?page_id=867
Flow Chart	Refer to Appendix 20
Revision history	Not applicable

FLOW CHART OF MANAGEMENT OF PATIENT IN NON-OPERATING ROOM ANAESTHESIA (NORA)



Hand hygiene and wear an appropriate PPE

Ensure anaesthesia apparatus are in proper order

Checking / registration – in order
- Patient identification
- Procedure verification
- NBM
- ***For MRI** – refer to MRI suite protocol

Place patient in holding bay
- Stable hemodynamic status

Prepare and successfully assist in intubation

Transfer patient and proceed with the procedure

During Procedure
- Monitoring Hemodynamic
  - Assisting in extubation process
  - MRI cases (extubate in recovery unit
  - Care of patient in recovery

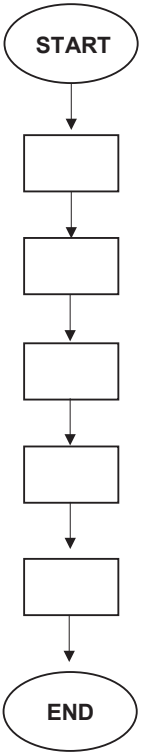
Documentation

PROCEDURE 21 : MANAGEMENT IN TRANSPORTATION OF CRITICALLY ILL PATIENT

Scope	Anaesthesia Technologist is responsible to conduct intrahospital and interhospital transportation of critically illpatient
Purpose	To ensure patient safety during transportation by providing an appropriate monitoring and medical care standard
Materials / Equipment	1. PPE 2. Transport ventilator 3. Oxygen cylinder 4. Schrader valve regulator or pin index regulator 5. Transport physiological monitor 6. Resuscitation kit 7. Airway management device 8. Infusion and syringe pump 9. Portable suction pump 10. Defibrillator or AED 11. Documentation
Work Process	1. Hand hygiene 2. Wear an appropriate PPE 3. Test and prepare equipment for transportation 4. Setting up ventilator parameters as per order by MO / specialist or based on previous ventilator setting and connect ventilator circuits to patient 5. Monitor closely for any hemodynamic changes during transportation 6. Documentation
Reference	Eiding, H., Kongsgaard, U. E., & Braarud, A. (2019). Intrahospital Transport of Critically Ill Patients: experiences and challenges, a qualitative study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 27*(1). Droogh, J. M., Smit, M., Hut, J., De Vos, R., Ligtenberg, J. J., & Zijlstra, JG. (2012). Inter-

	hospital transport of critically ill patients; expect surprise. *Critical Care. London England*. *16*(1). Https://doi.org/10.1186/cc11191 Jayasekera, D. C., Goonathillake, D. B., & Hapiarachchi, D. S. (2015). Guidelines for transport of adult critical care patient in Sri Lanka. *Critical Care of Medicine.* Kiss, T., Bolke, A., & Spieth, P. M. (2017). Interhospital transfer of critically ill patient. *Minerva Anesthesiology. 83.* 1101-1108. Parveez, M. Q., Yaddanapudi, L. N., Saini, V., Kajjal, K., & Sharma, A. (2022). Critical events during intra-hospital transport of critically ill patients to and from intensive care unit. *Turkish Journal of Emergency Medicine. 20*(3). 135-141. https://doi.org/10.4103/2452-2473.290067. Recommendation of Minimum Standard For Inter-facility Transport of the critically ill patients. (2016). College of Anaesthesiologists Academy of Medicine of Malaysia.
Flow Chart	Refer to Appendix 21
Revision history	Not applicable

FLOW CHART MANAGEMENT OF TRANSPORTATION CRITICALY ILL PATIENT



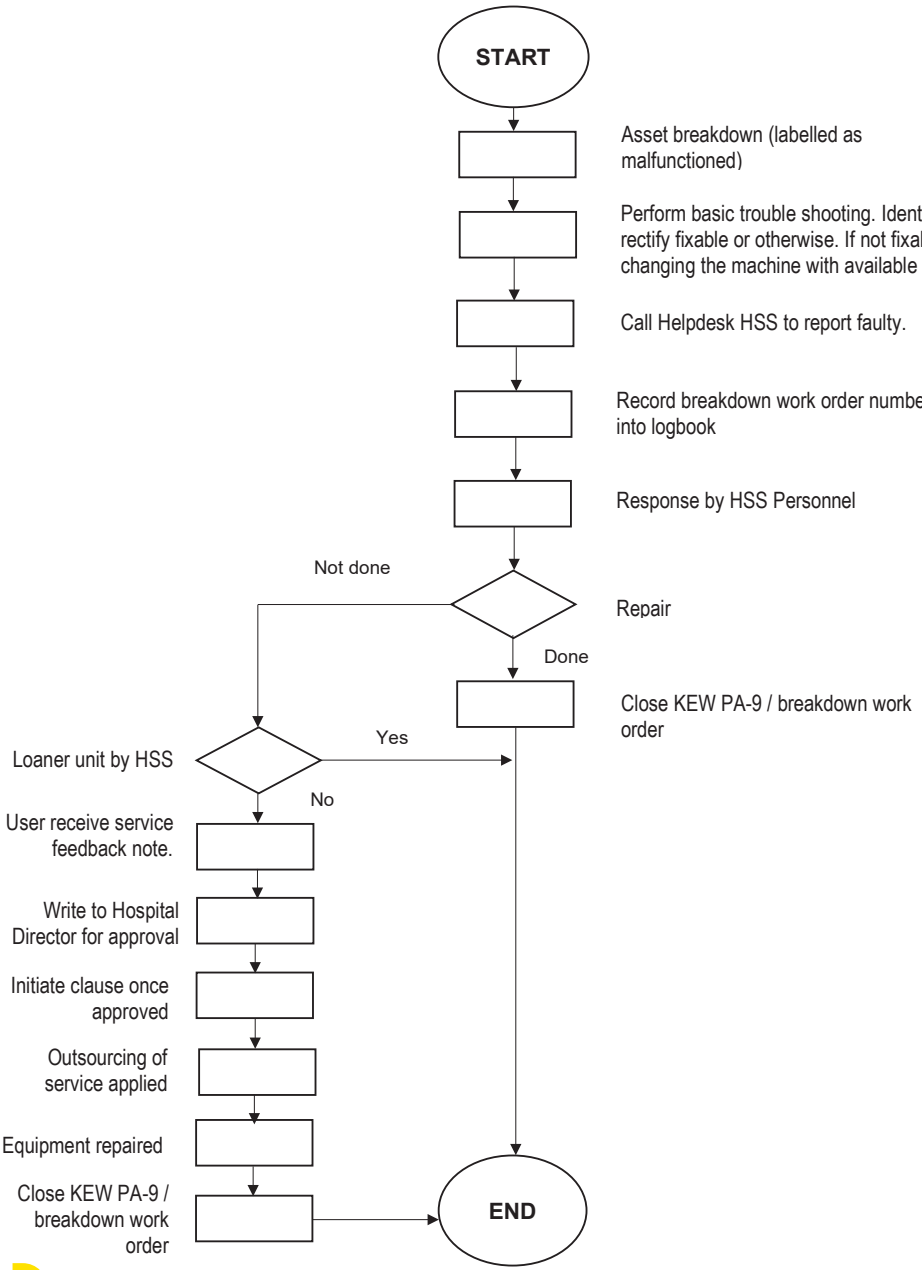
PROCEDURE 22 : HANDLING OF MALFUNCTIONED MEDICAL EQUIPMENT

Scope	Anaesthesia Technologist is responsible for facilitating and coordinating in handling malfunctioned equipment according to HSS guidelines
Purpose	To minimize service interruption and ensure patient safety is not compromised due to malfunctioned equipment
Materials / Equipment	1. Computer 2. Networking – ASIS 3. Malfunctioned equipment 4. KEW.PA-9 5. Breakdown logbook 6. Service Request Form
Work Process	1. Identify malfunctioned equipment and labelled as a "malfunctioned". 2. In the event of any faulty occurs to the Anaesthesia machine, perform basic trouble shooting to identify and verify the problem. If unable to fix it, consider changing the machine with an available backup unit. Then complain to HSS immediately for further management. This measure applies to any faulty that may crop up before, during, or after any procedure. 3. Obtain work order number from HSS and enter into breakdown logbook. 4. Ensure physical respond by HSS personnel – response time complied: i. BEMS - Emergency (critical equipment within 15 minutes). - normal (non-critical equipment within 2 hours). ii. eFEMS - emergency (critical equipment within30 minutes). - normal (non-critical equipment within 3 hours). 5. User verify work order and acknowledge response time. 6. Onsite repair by HSS; i. if onsite repair successful, user verify it before closing the work order.

	ii. if onsite repair unsuccessful, HSS staffs shall move the equipment to their workshop by filling up service form (HSS) and KEW.PA-9 (user). 7. HSS to provide a loaner unit if equipment is not able to be repaired within stipulated time. 8. HSS to submit repair progress after 7 working days to end user (feedback note). 9. If repair is done within 7 working days, close the work order and KEW.PA-9. 10. If HSS unable to provide a loaner unit, end user to request and obtain consent from hospital director to initiate: i. Clause 12.1 (14 days): - Government's Right to Procure Third Party. ii. Clause 44.1 (emergency): - Event Of Emergencies. iii. Clause 44.2 (24 hours): - Immediate diagnosis and/or treatment of patients required 11. Outsourcing of service applied 12. Once unit has been repaired, end user closes the work order of HSS and KEW.PA-9
Reference	Bahagian Perkhidmatan Kejuruteraan. (2013). Project operation Guidelines on Facility Engineering Maintenance Services. Kementerian Kesihatan Malaysia. https://silo.tips/download/bahagian-perkhidmatan-kejuruteraan-kementerian-kesihatan-malaysia Borang Permohonan Pergerakan/Pinjaman Aset Alih KEW. PA-0P Pekeliling Perbendaharaan Malaysia. General Hospital Operational Policy. (2013). Medical Development Division. Ministry of Health Malaysia. Panduan Pengguna Sistem Pengurusan Aset. (2007). Pengurusan aset kerajaan.

	Kementerian Kewangan Malaysia. http://sppa-hq.moh.gov.my/portalSpa/document/Manual_Pengurusan_Aset.pdf Panduan Pengguna Penyelenggaraan dan Program Sokongan Sistem Pengurusan Aset. (2011). Sistem pengurusan aset. Kementerian Kewangan Malaysia. http://sppa-hq.moh.gov.my/portalSpa/document/manualtot.pdf Pekeliling Perbendaharaan Bilangan 5. (2007). Tatacara pengurusan aset alih kerajaan. Kementerian Kewangan Malaysia.
Flow Chart	Refer to Appendix 22
Revision history	Not applicable

FLOW CHART OF HANDLING MALFUNCTIONED MEDICAL EQUIPMENT



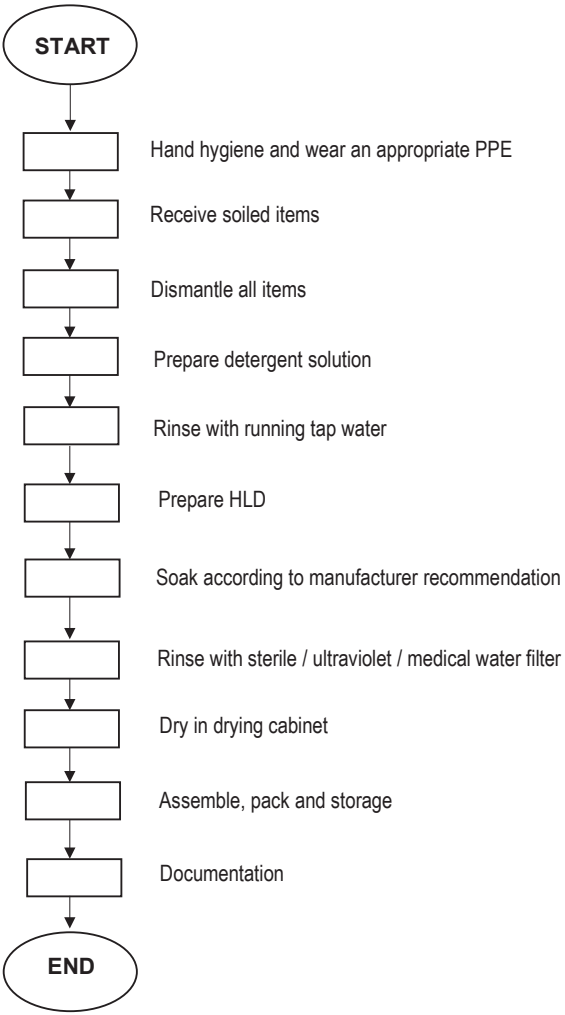
PROCEDURE 23 : CLEANING, DECONTAMINATION AND STERILIZATION OF MEDICAL APPARATUS

Scope	Anaesthesia Technologist is responsible to ensure that any medical apparatus used to provide care for patients is being cleaned, disinfect and sterilized according to current standards and hospital infection control guidelines
Purpose	To achieve effective disinfection and sterilization of medical apparatus to prevent any transmission of infectious pathogens to patient and HCW
Materials / Equipment	1. PPE: i. mask (3 ply or R95 or N95) ii. Goggles or face shields iii. Long-sleeved fluid-repellent gown (isolation gown) iv. Apron (long apron, disposable apron) v. gloves vi. Boots (shoes or boots cover) 2. High-Level Disinfectant (HLD) 3. Detergent solution or enzymatic cleaning solution 4. Tap water 5. Tube dryer 6. Cleaning brush 7. Sterile or ultraviolet or disposable water filter 8. Drying cabinet 9. Transparent plastic bag 10. Sealer machine
Work Process	1. Hand hygiene 2. Wear appropriate PPE 3. Receive soiled item 4. Dismantle all items 5. Prepare detergent solution (refer manufacturer recommendation for dilution and contact time) 6. Clean with a brush and rinse with running water to remove visible foreign material 7. Prepare HLD (refer manufacturer recommendation fordilution and contact time) 8. Soak accordingly to manufacturer recommendation 9. Rinse with a sterile or ultraviolet or medical water filter 10. Dry in a drying cabinet

	11. Assemble, pack and store 12. Documentation
References	Baheti, K. B. & Laheri, V. V. (2015). Understanding Anesthetic Equipment & Procedure Approach: A Practical Approach. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. Council Members, College of Anaesthesiologists, Academy of Medicine of Malaysia. (2014). Guidelines on infection control in anaesthesia. College of Anaesthesiologists, Academy of Medicine of MalaysiaBorang Permohonan Pergerakan/Pinjaman Aset Alih KEW. PA-0P Pekeliling Perbendaharaan Malaysia. Geneva: World Health Organization; (2014). Infection Prevention and Control of Epidemic- and Pandemic- Prone Acute Respiratory Infections in Health Care. Annex I, Cleaning and disinfection of respiratory equipment. Https://www.ncbi.nlm.nih.gov/books/NBK214361/ Josephs-Spaulding, J., & Singh, O. V. (2021). Medical Device Sterilization and Reprocessing in the Era of Multi drug-Resistant (MDR) Bacteria: Issues and Regulatory Concepts. Frontiers in medical technology, 2, 587352. https://doi.org/10.3389/fmedt.2020.587352 Juwarkar, C. S. (2013). Cleaning and sterilization of anaestheticequipment. Indian journal of anaesthesia. 57(5), 541– 550. doi:https://doi.org/10.4103/0019-5049.120152 Ling, M. L., Ching, P., Widitaputra, A., Stewart, A., Sirijindadirat,N., & Thu, L. (2018). APSIC guidelines for disinfection and sterilization of instruments in health care facilities. Antimicrobial resistance and infection control. 7(25). https://doi.org/10.1186/s13756-018-0308-2. Lee, C. Y. (2006). Manual of anaesthesia. Singapore: McGraw Hill Education.

	MOH, M. (2010). Policies and procedures on infection control (2nd ed.). Ministry of Health Malaysia. Shintani H. (2017). Ethylene oxide gas sterilization of medical devices. Biocontrol Sci. 22:1–16. World Health Organization. (2016). Decontamination and reprocessing of medical devices for health-care facilities. World Health Organization. Retrieved from https://apps.who.int/iris/handle/10665/250232
Flow Chart	Refer to Appendix 23
Revision history	Standard Operating Procedures for Assistant Medical Officer in Anesthesiology MOH (2007)

FLOW CHART OF CLEANING, DECONTAMINATION AND STERILIZATION OF MEDICAL APPARATUS



PROCEDURE 24 : PREPARATION AND SETTING UP OF CAPNOGRAPHY MONITORING

Scope	Anaesthesia Technologist is responsible to facilitate measurement and monitoring of patient's end tidal carbon dioxide concentration using graphic and numeric display
Purpose	To provide continuous and instantaneous measurement of physiologic information on ventilation and be able to identify potential breathing complications (airway obstruction, hyperventilation, hypoventilation or apnoea)
Materials / Equipment	1. PPE 2. Gas sampling line 3. Capnography module (main-stream or side-stream) 4. Capnometer (with display of end tidal carbon dioxide waveform and numeric) 5. Water trap (D-fend)
Work Process	1. Hand hygiene 2. Wear an appropriate PPE 3. Assemble gas sampling line between the patient end and capnography module 4. For mainstream method, end tidal CO2 sensor and a sampling cell are integrated into a small device adaptor thatconnect directly at the airway between the breathing circuit and ETT 5. Calibrate the capnometer (follow manufacturer's recommendations) 6. Check for presence of capnography waveform upon exhalation at patient end 7. Documentation: i. Document any related information ii. Inform MO orspecialist if any abnormalities observed
References	Brochard L. Martin GS, Blanch L, et.al (2012). Clinical Review:Respiratory monitoring in the ICU-a consensus of 16. *Critical Care. 16*(2). 219. Karaali, R., Çakır, A., Bora, E. S., Akyol, P. Y., Kavalcı, C., & Acar, H. (2022). The Evaluation of End Tidal Carbon Dioxide Values in Intubated Patients with COVID-

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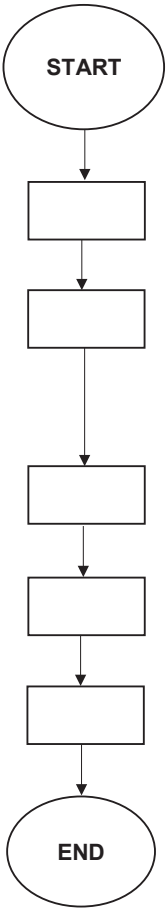
Flow Chart	Refer to Appendix 24
Revision history	Not applicable

FLOW CHART PREPARATION AND SETTING UP CAPNOGRAPHY MONITORING



Hand hygiene and wear an appropriate PPE

Assemble gas sampling line between the patient end and capnography module (sidestream method) or integrate end tidal CO2 sensor and a sampling cell into a small device adaptor (mainstream method)

Calibrate the capnometer

Check for presence of capnography waveform upon exhalation at patient end

Documentation

PROCEDURE 25 : PREPARATION AND SETTING UP OF PRESSURE TRANSDUCER SYSTEM

Scope	Anaesthesia Technologist is responsible to prepare pressure transducer system on patient who requires close monitoring
Purpose	To provide Medical Officers or specialist with real-time access to their patient's hemodynamic and cardiovascular status in anaesthesia and intensive care settings
Materials / Equipment	1. Physiological monitoring system with IBP capability 2. Pressure transducer kit 3. Transducer cable – interface connection with physiological monitor 4. Normal Saline 0.9% 500ml 5. Pressure infusion bag 6. IV pole (if applicable) 7. Transducer holder (attach to IV pole)
Work Process	1. Wear an appropriate PPE 2. Preparation of the equipment 3. Monitor setup: i. Turn on the physiologic monitor ii. Plug the pressure cables into the appropriate pressure modules or jacks in the bedside monitor iii. Some monitors are pre-programmed to display the waveform that corresponds to the module or jack (e.g., first position, arterial; second position, PA; third position, RA) iv. Select the desired waveform label. 4. Set up the pressure transducer kit: i. Prepare the pressure infusion bag and transducer system ii. Open the pre-packed pressure transducer kits under aseptic technique - Single-pressure tubing kit for arterial monitoring - Double-pressure tubing kit can be used for CVP and arterial monitoring iii. Ensure all connections are tight iv. Invert the N/Saline bottle v. Spike the outlet port of the N/Saline bottle with the pressure tubing, keeping the drip chamber upright.

	5. Insert the N/Saline into the pressure bag and hang it on the IV pole 6. Flush the entire system, including the transducer, stopcock,and pressure tubing, with the flushing solution 7. Replace the vented cap on the stopcock with a non-vented cap 8. Connect the arterial line to a pressure infusion bag of N/saline 9. Inflate the pressure infusion bag to 300mmHg (exclude for ICP) 10. Attach the transducer into the pole mount transducer holder 11. Level the arterial line at the phlebostatic axis 12. Calibrate the transducer: i. Suspend the monitor alarms ii. Turn off the three-way stop cock connector tap at the transducer. This blocks all pressure readings from the patient iii. Remove the cap iv. Select the "ART or ABP" parameter display on the monitor v. Flush the normal saline for "zeroing" vi. Press the "Zero" icon vii. Flattened pressure waveform will be appeared and the viii. Pressure value will be seen to return to '0' ix. Turn off to air the three-way stop cock at the transducer, replace the red cap and turn on towards the patient x. The pressure waveform and values will reappear on the monitor 13. Observe limb perfusion distal to the insertion site especially when withdrawing blood or flushing the cannula 14. Ensure the pressure transducer system are well secured at a secondary anchorage point to reduce the risk of accidental removal 15. Pressure transducer system needs to be re-calibrated upondisconnection of patient 16. Continuous monitoring the pressure transducer waveform and troubleshoot if needed 17. Documentation
Reference	American Association of Critical-Care Nurses. (2016). Pulmonary artery/central venous pressure monitoring in adult. *Critical Care Nurse.* 36(4). Bernd, S., Karim, K., Agnes, S. M., Leonie, S. U., & Stefano, R. (2020). How to measure bloodpressure using an arterial catheter: a systematic 5-step approach. *Critical Care. 24*(172).

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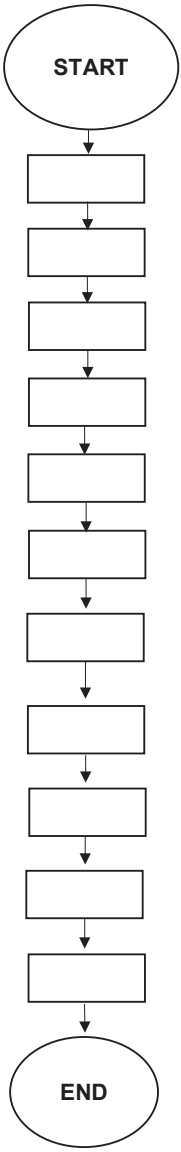
Flow Chart	Refer to Appendix 25
Revision history	Not applicable

Appendix 25

FLOW CHART PREPARATION AND SETTING UP OF PRESSURE TRANSDUCER SYSTEM



PROCEDURE 26 : REPROSESSING AND PREPARATION OF BAG VALVE MASK DEVICE

Scope	Anaesthesia Technologist is responsible in reprocessing (according to hospital infection control guidelines) and preparation of BVM to ensure it is functioning well before use on patient
Purpose	To ensure BVM functioning well and safe to use on patient
Materials / Equipment	1. PPE 2. Bag valve mask device 3. Oxygen tubing 4. Storage container 5. Transparent plastic bag 6. HLD
Work Process	1. Cleaning i. Hand hygiene ii. Wear an appropriate PPE iii. Dismantle the bag valve mask parts iv. Ensure all parts are complete v. Check the valves and reservoir bag are intact vi. Wash all the BVM parts thoroughly with running water before soaking in the HLD solution vii. Rinse in sterile water and dry it in drying cabinet

PICTURE 1: Bag Valve Mask components

2. Assemble:

   i. Ensure all parts are assembled according to manufacturer operating manual:

      - Face mask
      - Expiratory valve
      - Pressure relief valve (pop off valve)
      - Self-inflating bag
      - Air-inlet and pressure release valves
      - Air-inlet one-way valve
      - Reservoir bag

3. Function test:

   i. Ensure all accessories attached to BVM

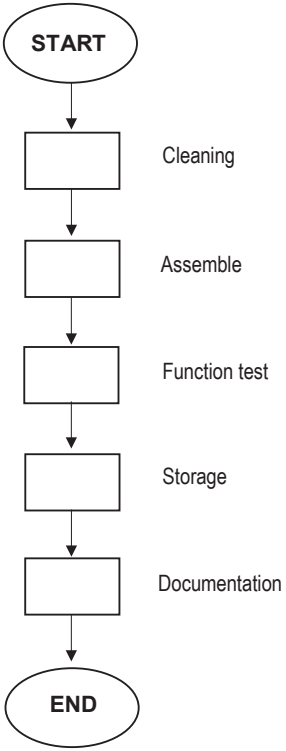
   ii. Air-inlet one-way valve test:

      - Squeeze the self-inflating bag with one hand and occlude patient end with the other hand
      - Release the bag, rapid bag re-expansion confirms the efficient air intake
      - Occlude the patient end and squeeze the bag again
      - If the bag cannot be squeezed with reasonable force, air-inlet one-

	way valve is patent - Attach the to the self-inflating bag to testthe oxygen nipple (oxygen socket): - Occlude the reservoir port of the self-inflating bag and squeeze it - Slow re-expansion of the bag confirms the oxygen nipple (oxygen socket) is intact iii. Squeeze the self-inflating bag several times andinspect the expiratory valve at the patient end opens during squeezing iv. Reservoir bag: - Test patency of the reservoir bag by inflating the bag and ensure no leak v. Reservoir flap valves (air- inlet and pressure release valve): - Attach reservoir bag to the self-inflating bag - Allow reservoir bag to fill up - Squeeze the reservoir bag and visualize the rise of the pressure release valve - This confirms the pressure release valve efficiently vents excessive gas to atmosphere - Perform several compression-release cycles on the self-inflating bag until reservoir bag is flat and empty - Rapid re-expansion of the self-inflating bag afterflattening of the reservoir bag and visual movement of the air inlet one way valve confirms this one-way valve efficiently lets in ambient air to compensate for lack of gas in the reservoir bag or insufficient gas flow through oxygen tubing and nipple vi. Storage: - Store in storage container or transparent plastic bag for the next patient use 4. Documentation
Reference	Bucher, J. T., Vashisht, R., Ladd, M., & Cooper. J. S. (2022) Bag Mask Ventilation. National Library of Medicine. https://www.ncbi.nlm.nih.gov/books/NBK441924/?report=classic.

	Carlson, J. N., & Wang, H. E. (2018). Updates in emergency airway management. *Current opinion in critical care. 24*(6). 525–530. https://doi.org/10.1097/MCC.0000000000000552. Kroll, M., Das, J., & Siegler, J. (2019). Can Altering Grip Technique and Bag Size Optimize Volume Delivered with Bag-Valve-Mask by Emergency Medical Service Providers? Prehospital emergency care. *Official journal of the National Association of EMS Physicians and the National Association of State EMS Directors, 23*(2). 210–214. https://doi.org/10.1080/10903127.2018.1489020 Sall, F. S., De Luca, A., Pazart, L., Pugin, A., Capellier, G., & Khoury, A. (2018). To intubate or not: ventilation is the question. A manikin-based observational study. *BMJ open respiratory research. 5*(1). https://doi.org/10.1136/bmjresp-2017-000261. Strzelecki, C., Shelton, C. L., Cunningham, J., Dean, C., Naz- Thomas, S., Stocking, K., & Dobson, A. (2020). A randomized controlled trial of bag-valve-mask teaching techniques. *The clinical teacher. 17*(1). 41–46.
Flow Chart	Refer to Appendix 26
Revision history	Not applicable

FLOW CHART OF REPROCESSING AND PREPARATION OF BAG VALVE MASK DEVICE



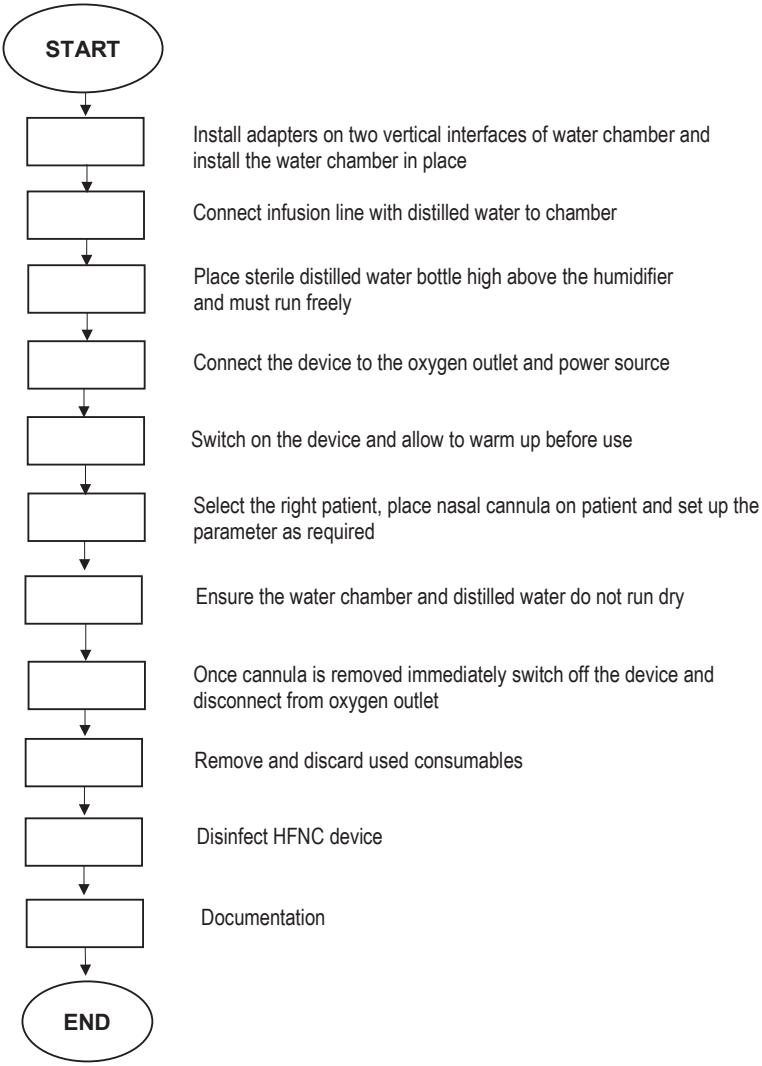
PROCEDURE 27 : PREPARATION AND REPROSESSING OF HIGH FLOW NASAL CANNULA (HFNC)

Scope	Anaesthesia Technologist is responsible in preparation and reprocessing of device according to hospital infection control guidelines and perform troubleshooting according to manufacturer protocols
Purpose	To accomplishes reduction of nasopharyngeal airway resistance, leading to improved ventilation and oxygenation through the application of a positive pressure environment
Materials / Equipment	1. PPE 2. HFNC device 3. Disinfection wipes 4. Humidifier chamber 5. Heated inspiratory circuit 6. Nasal Cannula 7. Sterile distilled water 500ml (IV bottle) 8. Physiological Monitoring System 9. Oxygen flow meter and tubing
Work Process	1. Pre-use: i. Hand hygiene ii. Wear an appropriate PPE iii. Install adapters on two vertical interfaces of water chamber according to the direction and press tightly with force iv. Install the water chamber in place v. Connect infusion line with distilled water to chamber vi. Sterile distilled water bottle must run freely and be placed high above the humidifier to achieve free flowof water into the humidifier vii. Connect the device to the oxygen outlet and power source viii. Switch on the device and allow to warm up before use ix. Select the right mode with the right category of patient (adult or paediatric) x. Place nasal cannula on patient; - Ensure cannula sit snugly in the patient's nares xi. Set up the parameter as required

	2. Intra-use: i. The patient interface and head band are adjusted, so that the patient feels comfortable ii. Always ensure that the water chamber and distilled water bottle are not dry iii. Monitor patient's SpO2 status iv. Titrate FiO2 and flow rate as required 3. Post-use: i. Once cannula is removed, immediately switch off the device. ii. Disconnect from oxygen outlet iii. Remove and discard HFNC set iv. Disinfect HFNC as per manufacturer disinfection guidelines 4. Documentation
Reference	Corley, A., Rickard, C. M., Aitken, L. M., Johnston, A., Barnett, A., Fraser, J. F., Lewis, S. R., & Smith, A. F. (2017). High-flow nasal cannula for respiratory support in adult intensive care patients. *The Cochrane database of systematic reviews.* 5(5). https://doi.org/10.1002/14651858.CD010172.pub2 Hacquin, A., Perret, M., Manckoundia, P., Bonniaud, P., Beltramo, G., Georges, M., & Putot, A. (2021). High- Flow Nasal Cannula Oxygenation in Older Patients with SARS-CoV-2-Related Acute Respiratory Failure. *Journal of clinical medicine. 10*(16). 3515. https://doi.org/10.3390/jcm10163515 Lewis, S.R., Baker, P. E., Parker, R., & Smith, A.F. (2021). High-flow nasal cannula for respiratory support in adult intensive care patients. *Cochrane Database of SystematicReviews.* doi: 10.1002/14651858.CD010172.pub3. Parke, R., McGuinness, S., & Eccleston, M. (2009). Nasal high-flow therapy delivers low level positive airway pressure. *British journal of anaesthesia. 103*(6). 886–890. https://doi.org/10.1093/bja/aep280. Rodriguez, M., Ragot, S., & Coudroy, R. (2021). Non-invasive ventilation vs. high-flow nasal cannula oxygen for preoxygenation before intubation in patients with

	obesity: a post hoc analysis of a randomized controlled trial. *Annals of Intensive Care 11*(1): 114.
Flow Chart	Refer to Appendix 27
Revision history	Not applicable

FLOW CHART OF MANAGEMENT OF HIGH FLOW NASAL CANULA



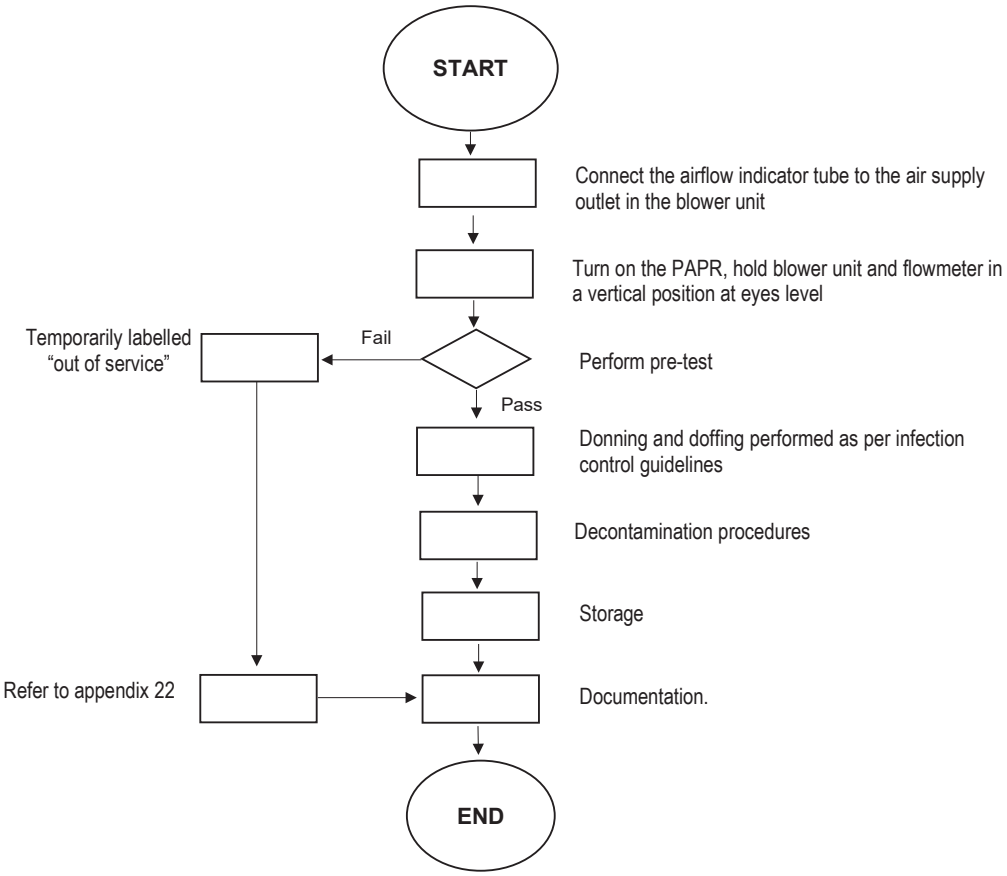
PROCEDURE 28 : PREPARATION AND REPROSESSING OF POWERED AIR PURIYING REPIRATOR (PAPR)

Scope	Anaesthesia Technologist is responsible to manage and reprocess PAPR device according to hospital infection control guidelines
Purpose	To safeguard Health Care Workers while performing high-risk aerosol generating procedures
Materials / Equipment	1. PPE 2. Filtering face piece respirator, 3ply mask or N95 mask 3. Face piece or visor or long hood 4. Hose 5. HEPA filter 6. Blower unit 7. Battery pack (power source) 8. Waist band
Work Process	1. Hand hygiene 2. Wear an appropriate PPE 3. Connect the airflow indicator tube to the air supply outlet in blower unit 4. Turn ON the PAPR 5. Hold blower unit and ensure flow meter in a vertical position at eye level (follow the manufacturer's recommendations) 6. Perform pre-test as recommended by manufacturer. Do not use the PAPR if test failed and refer to Appendix 22 7. Donning and doffing are performed as per infection control guidelines 8. Consideration for filter change, if: i. There is airflow blockage alarm either by sound alarm or change in the color ii. Visibly dirty, wet, damaged or bad odor

	iii. The device does not pass the airflow test even with a fully charged battery iv. After 30 days from initial use as per manufacturerrecommendation 9. Decontamination procedures: i. While wearing gloves, disconnect all component part of PAPR; battery pack, breathing hose and head hoodfrom the blower unit ii. Inspect all parts for any damage iii. Clean the external surfaces with HLD spray (head- hood, blower unit, battery pack) iv. Replace the plastic cover of breathing hose after each use and immersed in water for cleaning if visibly dirty or contaminated v. Disinfect all component parts by using disinfectant wipes vi. Do not spray the blower unit directly vii. Do not clean cartridges or filters viii. Wipe the interior part of the hood with disinfectant wipe ix. Allow air dry for the blower unit, breathing hose,battery pack, and hood or helmet 9. Storage: i. Store in a clean, contaminant free environment, protected from prolonged exposure to heat, sunlight, radiation and chemicals ii. The motor or blower should be run at least 3 monthly for 5 minutes and subsequently recharge the battery pack to ensure continued proper lubrication of the motor according to manufacturer recommendations iii. PAPR filters should not be stored long-term in the motor or blower as this may damage the filter gasket iv. The battery must be charged after each use 10. Documentation

Reference	Cleaning Reusable Respirators and Powered Air Purifying Respirator Assemblies. (2017). Technical Data Bulletin. 3M Scienc. Applied to Life. https://multimedia.3m.com/mws/media/988556O/tdb-cleaning-reusable-respirators-and-papr-assemblies.pdf Conducting Airflow Check on the 3M VERSAFLO PAPR TR-600. (2014). Technical Data Bulletin. 3M Scienc. Applied to Life. https://multimedia.3m.com/mws/media/1000745O/conducting-airflow-check-on-the-3m-versaflo-papr-tr-600-technical-bulletin.pdf Fink, J. B., Ehrmann, S., Li, J., Dailey, P., McKiernan, P., Darquenne, C., Martin, A. R., Rothen-Rutishauser, B., Kuehl, P. J., Häussermann, S., MacLoughlin, R., Smaldone, G. C., Muellinger, B., Corcoran, T. E., & Dhand, R. Guidelines on the use of Powered Air Purifying Respirator. (2020). Reducing Aerosol-Related Risk of Transmission in the Era of COVID-19: An Interim Guidance Endorsed by the International Society of Aerosols in Medicine. *Journal of aerosol medicine and pulmonary drug delivery*, *33*(6), 300–304. https://doi.org/10.1089/jamp.2020.1615 Guidelines on Infection Prevention and Control (IPC) measures in Managing Person Under Surveillance (PUS), Suspected, Probable or Confirmed Coronavirus Disease (COVID-19). (2022). Annex 8. Ministry of Health Malaysia. https://covid-19.moh.gov.my/garis-panduan/garis-panduan-kkm/ANNEX-8-IPC-MEASURES-IN-MANAGING-PUS-SUSPECTED-PROBABLE-CONFIRMED-COVID-19-09032022.pdf Guidelines on the use of Powered Air Purifying Respirator. (2020). Department of Infection Prevention and Control. Directorate General for Disease Surveillance and Control.
Flow Chart	Refer to Appendix 28
Revision history	Not applicable

FLOW CHART OF PREPARATION AND PROCESSING PURIFIED AIR PURIFYING RESPIRATOR



Glossary

Allen Test	Used to assess collateral blood flow to the hands, generally in preparation for a procedure that has the potential to disrupt blood flow in either the radial or the ulnar artery
Anesthesia machine	A medical device used to generate and mix a fresh gas flow of medical gases and inhalational anesthetic agents for the purpose of inducing and maintaining anesthesia
ASA Physical Classification	The ASA (American Society of Anesthesiology) score is a metric to determine if someone is healthy enough to tolerate surgery and anesthesia. The American Society of Anesthesiologists (ASA) Physical Status Classification System is a tool used in preparation for surgery to help predict risks in a given patient
Autoclave Machine	They are used to decontaminate certain biological waste and sterilize media, instruments and lab ware with high temperature and pressure in order to kill microorganisms
Autologous blood transfusion	The collection of blood from a single patient and re-transfusion back to the same patient when required
Arterial Blood Gas	Measures the Amounts of arterial gases, such as oxygen and carbon dioxide. An ABG test requires that a small volume of blood be drawn from the radial artery with a syringe and a thin needle, but sometimes the femoral artery in the groin or another site is used
Awake flexible Intubation	Awake flexible intubation involves placing a tracheal tube in an awake, spontaneously-breathing patient, most commonly with flexible bronchoscopy. This allows the airway to be secured before induction of general anesthesia, avoiding the potential risks and consequences of difficult airway management in an anaesthetized patient
Bain circuit	The Bain circuit is a "coaxial" Mapleson D- the same components, but the fresh gas flow tubing is directed within the inspiratory limb, with fresh gas entering the circuit near the mask
Berman Airway	Side channels enable use of suction catheters without obstructing the airway, allowing for additional air flow
Biofilm	A thin but robust layer of mucilage adhering to a solid surface and containing a community of bacteria and other microorganisms
Bispectral Index (BIS)	One of several technologies used to monitor depth of anesthesia

Glossary

Breathing circuit	To deliver oxygen and anesthetic gases, and eliminate carbon dioxide
Bromage Score	An accepted tool for the measurement of motor block. This scale assesses the intensity of motor block by the patient's ability to move their lower extremities
BURP Maneuver	Applying backward, upward, rightward, and posterior pressure on the larynx (i.e., displacement of the larynx in the backward and upward directions with rightward pressure on the thyroid cartilage) for visualized of the vocal cord
BVM	Bag-Valve-Mask. In BVM ventilation, a self-inflating bag (resuscitator bag) is attached to a nonrebreathing valve and then to a face mask that conforms to the soft tissue of the face of patient.
Capnography	The monitoring of the concentration or partial pressure of carbon dioxide in the respiratory gases. Its main development has been as a monitoring tool for use during anesthesia and intensive care
Carina	A ridge at the base of the trachea (windpipe) that separates the openings of the right and left main bronchi (the large air passages that lead from the trachea to the lungs)
Cricoid Pressure	also known as the Sellick maneuver or Sellick maneuver, is a technique used in endotracheal intubation to try to reduce the risk of regurgitation
Diameter Index Safety System	A set of engineering standards preventing users of compressed gases from linking pressurized gas holding tanks to the wrong hoses or tubing. The standards designate specific-sized connectors for each different medical gas. The system is designed to prevent delivering room air or nitrogen to a patient in need of oxygen therapy
Flowmeter	An instrument that is used to indicate the Amount of liquid, gas, or vapor moving through a pipe or conduit by measuring linear, non-linear, mass or volumetric flow rates
HEPA filter	A HEPA (High Efficiency Particle Arresting) filter can substantially reduce the amount of airborne contaminants, such as mould spores, dust, dust mites, pet dander, and irritant allergies. The usage of a HEPA filtration system can be beneficial in reducing the number of allergens circulating in the air, in addition to other strategies to do so, such as routine dusting.
Heat and Moist Exchanger	A device used in mechanically ventilated patients intended to help prevent complications due to "drying of the respiratory mucosa, such as mucus plugging and endotracheal tube (ETT) occlusion."

Glossary

Hypothermia	Defined as a body core temperature below 35.0 °C (95.0 °F) in humans
Luer lock	Luer-lock connectors (female) are joined by means of a tabbed hub on the female fitting those screws into threads in a sleeve on the male fitting and attaches securely. Male luer lock connectors are available with integral lock rings or with rotatable features to allow you to position the tubing before assembly. This locking mechanism is used for applications that require a secure connection
Magill Forcep	Magill forceps are angled forceps used to guide a tracheal tube into the larynx or a nasogastric tube into the esophagus under direct vision
Malignant Hyperthermia (MH)	A type of severe reaction that occurs in response to particular medications used during general anesthesia, among those who are susceptible. Symptoms include muscle rigidity, high fever, and a fast heart rate. Complications can include muscle breakdown and high blood potassium
Manometer	a device that is able to measure the pressure of a medium (a liquid, or a gas)
Minimum Alveolar Concentration (MAC)	The concentration of a vapor in the alveoli of the lungs that is needed to prevent movement (motor response) in 50% of subjects in response to surgical (pain) stimulus. MAC is used to compare the strengths, or potency, of anesthetic vapors
Mucosal Atomizer Device	intranasal mucosal atomization device delivers a mist of atomized medication that offers rapid absorption across mucosal membranes to the blood stream Atomized nasal medications offer rapid absorption across mucosal membranes into the brain and cerebrospinal fluid via olfactory mucosa to nose brain pathway
Nasal Pharyngeal Airway	A type of airway adjunct, a tube that is designed to be inserted into the nasal passageway to secure an open airway
Neuromuscular blocking agent	A chemical agent that paralyses skeletal muscles by blocking the movement of neurotransmitter at the neuromuscular junction
Ovassapian Airway	Used to provide an open oropharyngeal space and to introduce a fiberoptic bronchoscope at the midline of the oropharynx
Pacemaker	The cells that create these rhythmic impulses, setting the pace for blood pumping, are called pacemaker cells, and they directly control the heart rate

Glossary

Pathogens	A bacterium, virus, or other microorganism that can cause disease
PAPR	a respirator that purifies the air by blowing air into the wearer's breathing zone through filters or cartridges. In comparison to a powered half mask APR or one with negative pressure, this generates a positive pressure inside the facepiece or hood, offering greater protection.
Pharmacokinetic	Describes how the body affects a specific xenobiotic/chemical after administration through the mechanisms of absorption and distribution, as well as the metabolic changes of the substance in the body and the effects and routes of excretion of the metabolites of the drug
Pin Index	Connecting high pressure cylinders containing medical gases to a regulator or other utilization equipment. It uses geometric features on the valve and yoke to prevent mistaken use of the wrong gas. This system is widely used worldwide for anesthesia machines, portable oxygen administration sets, and inflation gases used in surgery
Scavenging system	A scavenger system is a medical device used in hospitals. It is used to gather gas or aerosolized medication after it is exhaled from the patient or left the area of the patient. Often used to collect anesthesia, it can also be used to collect any type of gas or aerosolized medicine that is intended only for the patient and should not be breathed in by any other medical personnel
Soda lime	Soda lime is a mixture of NaOH & CaO chemicals, used in granular form in closed breathing environments, such as general anesthesia, submarines, rebreathers and recompression chambers, to remove carbon dioxide from breathing gases to prevent CO2 retention and carbon dioxide poisoning
Target Controlled Infusion (TCI)	Automates the dosing of intravenous drugs during surgery. After the anesthetist sets the desired parameters in a computer and presses the start button, the system controls the infusion pump, while being monitored by the anesthetist. TCI is as safe and effective as manually controlled infusion
Total Intravenous Anesthesia (TIVA)	Intravenous administration of anesthetic agents to induce a temporary loss of sensation or awareness. TIVA is currently employed in various procedures as an alternative technique of general anesthesia in order to improve post-operative recovery.
T-piece circuit	A three-way T-tube whose limbs are connected to the fresh gas supply from the anesthesia machine, a length of corrugated reservoir tube and the patient connector. It has minimal dead space, no valves and minimal resistance

Glossary

Vacuum Insulated Evaporator	A form of pressure vessel that allows the bulk storage of cryogenic liquids including oxygen, nitrogen and argon for industrial processes and medical applications
Vaporizer	A substance that vaporizes or a device that causes vaporization. Medical device that produces steam or atomizes medication for inhalation

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