Clinical Practice Guideline

Volume 1

Department of Anaesthesiology and Intensive Care

Universiti Kebangsaan Malaysia
The National University of Malaysia

Naratif Baharu UKM
Universiti Watan Kita

HCTM
Hospital Canselor Tuanku Muhriz

Faculty of Medicine
The National University of Malaysia

Clinical Practice Guideline

Volume 1

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Disclaimer: This Clinical Practice Guideline is intended for use in Hospital Canselor Tuanku Muhriz, UKM only. It is based on the best available evidence at the time of development. All health care providers are responsible for the management of their patients based on the clinical picture.

Foreword

First and foremost, I would like to congratulate the Department of Anaesthesiology & Intensive Care, Faculty of Medicine & Hospital Canselor Tuanku Muhriz, Universiti Kebangsaan Malaysia for our first publication of Clinical Practice Guideline Volume 1.

Clinical Practice Guidelines have become a familiar part of everyday clinical practice in the making of clinical decisions at the bed side and the formulation of rules at the hospitals. This is to ensure the treatment that the patient receives is safe, current and in accordance with the best practices in our respective disciplines. We hope this document will serve as a useful guide for all practitioners of anaesthesiology in our department and fraternity.

I would like to express my gratitude to all the members of the department who have demonstrated excellent teamwork in the publication of the guidelines as its authors and reviewers. Special thanks also go to the editors, Assoc Prof Dr Muhammad Maaya and Dr Teng Hung Xin for their contribution to the production effort of these Clinical Practice Guideline.

Associate Professor Dr Azarinah Izaham

Head
Department of Anaesthesiology & Intensive Care
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Preface

It is my great honour and privilege to present this collection of Clinical Practice Guidelines (CPG) for the Department of Anaesthesiology & Intensive Care, Faculty of Medicine, Hospital Canselor Tuanku Muhriz, Universiti Kebangsaan Malaysia. Why do healthcare professionals need guidelines? Guidelines are needed to provide us recommendations on how to perform tasks, or the conduct of process in certain situations, for us to make informed decisions. They not only ensure that patients receive standardised care, improve quality and maintain safety, but also can provide a form of teaching and education. Guidelines can also help us make legal and ethical considerations in difficult circumstances.

Clinical Practice Guidelines has existed in our department for many years, but this marks the first time several are compiled in this format. This great idea originated from Associate Professor Dr Azarinah Izaham. Ably assisted by Dr Teng Hung Xin, we selected several areas which either require a new guideline or an updated version. As this project is a big undertaking, each member of the department was tasked with a guideline, supported by evidence-based practice and decision-making discussions.

I sincerely hope this compilation of CPGs will be an important reference point and manage to accomplish the benefits I have mentioned above. And we look forward to more future editions in time to come.

Associate Professor Dr Muhammad Maaya

Editor-in-Chief

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Abbreviations

AAGBI	Association of Anaesthetists of Great Britain and Ireland
ABG	Arterial blood gas
ACLS	Advanced Cardiovascular Life Support
ACT	Activated coagulation time
AOR	At own risk
APACHE	Acute Physiologic Assessment and Chronic Health Evaluation
APS	Acute Pain Service
BLS	Basic Life Support
BMI	Body Mass Index
CCU	Coronary Care Unit
CICU	Cardiothoracic Intensive Care Unit
CK	Creatinine kinase
COVID	Coronavirus disease
CPAP	Continuous positive airway pressure
CPB	Cardiopulmonary bypass
CPR	Cardiopulmonary resuscitation
CSE	Combined spinal-epidural
CSF	Cerebrospinal fluid
CT	Computed Tomography
CTC Anaes MO	Cardiothoracic Anaesthesia Medical Officer
CTG	Cardiotocography
CVC	Central venous catheter
ECG	Electrocardiogram
$ETCO_2$	End tidal carbon dioxide
ETT	Endotracheal tube
FiO_2	Fraction of inhaled oxygen
GICU	General Intensive Care Unit
HCTM	Hospital Canselor Tuanku Muhriz
HDS	High Dependency Surgical unit
HDU	High Dependency Unit
HFNC	High flow nasal cannula
HKL	Hospital Kuala Lumpur
HKLAAC	Hospital Kuala Lumpur Anaesthetic Allergy Clinic
HO	House Officer
HOD	Head of Department
HR	Heart rate
I:E	Ratio of inspiratory time to expiratory time
ICU	Intensive Care Unit
IV	Intravenous
KJ	Ketua Jururawat
KPI	Key performance indicator
LA	Local anaesthesia
LSO	Laser safety officer
M&M	Morbidity & mortality
MA	Medical Assistant
MAC	Monitored anaesthesia care
MCT	Mast cell tryptase
MH	Malignant hyperthermia
MO	Medical Officer
MOH	Ministry of Health
NIBP	Non-invasive blood pressure
NIV	Non-invasive ventilation

OSA	Obstructive sleep apnoea
OT	Operating theatre
PAC	Perioperative anaesthesia clinic
PACU	Post Anaesthesia Care Unit
PCA	Patient-controlled analgesia
PCEA	Patient-controlled epidural analgesia
pCO_2	Partial pressure of carbon dioxide
PCR	Polymerase Chain Reaction
PDPH	Post dural puncture headache
PEEP	Positive end expiratory pressure
pH	Potentials of Hydrogen
PIEB	Programmed Intermittent Epidural Bolus
PPE	Personal protective equipment
PS	Pain score
RICU	Registrar Intensive Care Unit
ROX	Ratio of oxygen saturation
RR	Respiratory rate
RTK	Rapid test kit
SARI	Severe acute respiratory infection
SOFA	Sequential Organ Failure Assessment
SOP	Standard operating procedure
SpO_2	Saturation of peripheral oxygen
TCI	Target Controlled Infusion
TIVA	Total Intravenous Anaesthesia
UKM	Universiti Kebangsaan Malaysia
VT	Tidal volume
WHO	World Health Organisation

Job Description for Clinicians in OT

Dr Syarifah Noor Nazihah Sayed Masri, Associate Professor Dr Muhammad Maaya

INTRODUCTION

1. Anaesthesiology and Intensive Care Services are among the major clinical specialty services provided by HCTM.
2. The purpose of these recommendations is to clearly define the duties of anaesthetic doctors.

HUMAN RESOURCES

1. The department is headed by a Consultant Anaesthesiologist, who has been appointed by the Hospital Director, and shall be responsible for the overall management of the department.
2. The HOD shall represent the department in the OT Committee to ensure effective interaction between the hospital administrator and the implementation of the services.
3. During the absence of the HOD, the next senior member/specialist shall take over his/her responsibilities.
4. All new employees shall attend a structured Orientation Program organised by the department or unit.
5. All categories of employees shall have respective job descriptions.

JOB DESCRIPTION

1. Head of Department
    1.1. Administrative
        - To attend designated meetings, set by HCTM and the Faculty of Medicine administration, such as Faculty Meetings, Department of Heads Meetings, Gazettement Special Committee Meetings and others.
        - To chair department meetings (academic and service) at least 3 times per year.
        - A member of Credentialing & Medical Privileges Committee Meeting.

- Member of the HCTM Surgical Committee meeting.
- To act as an advisor for various programs organized by the department (conducting training or community service programs).
- To act as first or second assessor for department staff (hospital and faculty appointments) in Sistem Penilaian Prestasi Universiti.
- To act as the Specification @ Technical Committee for medical devices @ hospital consumables (subject to appointment from the Finance Department, HCTM).
- To check and sign outgoing letters related to departmental services (hospital or faculty affairs).
- To approve the Tempahan Pesanan and confirm the Official Order Request Form (Borang Permohonan Pesanan Rasmi) through the uFast system (hospital affairs or research).
- To approve on-call duty schedules and claims for all consultants, specialists and MOs, online and manually.
- To sign various payment instructions @ bill register (hospital or faculty services).
- To approve various online applications, such as eCuti, eSpel, eMP, eREP, eMAR and others.
- To approve inventory and stock for departmental items.
- To certify the withdrawal of FPR31 @ Akaun Amanah Penjanaan of the Department of Anaesthesiology and Intensive Care for specific purposes.
- To ensure that all services under the Department of Anaesthesiology and Intensive Care are performed daily.
- Perform duties as directed by the Faculty Dean and HCTM Director from time to time.
- To organise a high-quality seminar at least once a year.
- To discuss and approve applications for administration of new drugs.

1.2. Academic

- To act as the Conjoint Board Committee for the Doctor of Anaesthesiology and Critical Care Program.
- To ensure that the Doctor of Anaesthesiology and Critical Care Program runs smoothly.
- To ensure that graduate programs run smoothly.
- To appoint a coordinator for each academic program in the department.
- To discuss matters related to academic programs at department meetings.
- To discuss and find solutions for problematic students.
- To represent the department for meetings related to the Conjoint

Master Program.

1.3. Clinical

- To ensure pre-anaesthetic assessment is conducted for patients in the anaesthetic clinic, ward or OT.
- To ensure effective, efficient and professional anaesthetic management are provided for elective and emergency cases.
- To ensure effective, efficient and professional intensive care management are provided for patients in the ICU.
- To ensure adequate pain relief are provided for post-operative patients and for parturient who requested for epidural labour analgesia.
- To provide professional, clinical leadership and supervision to specialists and MOs.
- To ensure appropriate conduct of resuscitation of patients.
- To ensure the teaching of Masters trainees, MOs, HOs, nurses, and MAs are organised.
- To undertake daily and on-call duties as per roster.
- To be up-to-date with trends and developments in anaesthesia, intensive care and pain management by keeping abreast of relevant literature, conferences and courses.

2. Consultant /Specialist

2.1. Administrative

- To assist the HOD in carrying out administrative duties.
- To orientate new MOs to the department on their roles and responsibilities.
- To carry out non-clinical duties as directed by the HOD or hospital director.
- To organise CME for personnel of the department e.g. Masters trainees, MOs, HOs, nurses, MAs.
- To attend talks, seminars, courses and conferences to improve and update knowledge.
- To participate in and implement department's CME activities, M&M meetings, Quality Assurance activities, research, patient satisfaction studies, innovation and KPIs.
- To assist in the organisation of department's courses e.g. APS.
- To assist the HOD for safety and quality improvement activities.
- To prepare OT schedules and on-call rosters.

2.2. Clinical

- To conduct pre-anaesthetic assessment for patients in the PAC, ward and OT.

- To provide effective, efficient and professional anaesthetic management for elective and emergency cases.
- To provide effective, efficient and professional intensive care management for patients in the ICU.
- To provide adequate pain relief for post-operative patients and for parturient who requested for epidural labour analgesia.
- To supervise junior specialists and MOs in the provision of anaesthesia.
- To provide and assist in the resuscitation of patients.
- To organise and undertake teaching of Masters trainees, MOs, HOs, nurses, and MAs.
- To undertake daily and on-call duties as per roster.
- To be up-to-date with trends and developments in anaesthesia, intensive care and pain management by keeping abreast of relevant literature, conferences and courses

2.3. Academic (for faculty member only)

- To be involved in teaching of undergraduate and postgraduate programs.
- To supervise students in the Doctor of Anaesthesiology & Critical Care postgraduate program.
- To supervise dissertation and research project for post graduate student.
- To become primary investigator for post graduate research program.
- To conduct examination for undergraduate medical program and Conjoint Exam for Anaesthesiology.
- To publish manuscripts in medical journals as directed by the university.

3. Medical Officers

3.1. To provide safe conduct of anaesthesia for patients undergoing elective and emergency surgery under specialist supervision by adherence to:

- Pre-anaesthetic assessment
- Fasting protocol
- Various level of checks on the anaesthetic machines
- Correct labelling of loaded syringe
- Pre-induction assessment of patient's vital signs and safety check list as per WHO recommendation (Save Surgery Save Lives)
- Post-anaesthesia monitoring and documented criteria before discharge from the recovery room (including objective scoring before discharge)
- Post-operative acute pain management plan

3.2 To attend the PAC under specialist supervision.

3.3 To perform daily and on-call duties as per roster.

3.4 To perform invasive procedures as privileged or under specialist supervision.
3.5 To be actively involved in patient resuscitation when necessary.
3.6 To provide basic intensive care for patients in the ICU.
3.7 To participate on a regular basis in the educational and audit program within the department.

4. House officer

4.1. To observe and perform safe conduct of anaesthesia under supervision of MO and specialist for patients undergoing elective and emergency surgery by adherence to:
- Pre-anaesthetic assessment
- Fasting protocol
- Various level of checks on the anaesthetic machines
- Correct labelling of loaded syringe
- Pre-induction assessment of patient's vital signs and safety check list as per WHO recommendation (Save Surgery Save Lives)
- Post-anaesthesia monitoring and documented criteria before discharge from the recovery room (including objective scoring before discharge)
- Post-operative acute pain management plan.

4.2. To attend the PAC under specialist and MO supervision.
4.3. To follow MOs and specialist during APS round.
4.4. To perform daily and on-call duties as per roster.
4.5. To perform basic airway procedures such as holding mask and intubation procedures under specialist or MOs' supervision.
4.6. To perform basic intraoperative procedure such as IV cannulation and ABG taking under specialist or MOs' supervision.
4.7. To be actively involved in patient resuscitation when necessary.
4.8. To complete a comprehensive anaesthetic report and documentation in the anaesthetic GA form while being closely supervised by a MO.
4.9. To participate on a regular basis in the educational and audit program within the department.

Post-Anaesthesia Recovery Room

Dr Liu Chian Yong, Dr Tan Tse Siang

INTRODUCTION

Post-anaesthesia care is an essential part of the perioperative care of patients after undergoing operation or procedure under any type of anaesthesia or sedation. The recovery room is a specialised area where patients are closely monitored and managed until they are stable enough to be transferred back to their respective wards. The recovery room plays a vital role in the safe and effective recovery of patients from the effect of anaesthesia, surgery and other related procedures. This guideline provides an overview of post-anaesthesia services, design features, equipment, medications, and staffing in the recovery room.

GENERAL PRINCIPLES

1. Patient Assessment:
   Upon arrival in the recovery room, each patient should receive a thorough assessment by a trained healthcare professional. Patient's medical history, surgical procedure, and anaesthetic medications should be reviewed. This assessment should include monitoring of ECG, NIBP, RR, and SpO_2, as well as the patient's level of consciousness and PS.

2. Monitoring:
   Continuous monitoring is essential in the recovery room, and patients should be monitored closely until they are stable enough to be transferred to the ward. There should be clear documentation of the hemodynamic parameters either manually or electronically. The frequency and type of monitoring will depend on the patient's medical condition and surgical procedure. In general, patients should be monitored for at least 30 minutes after surgery, or longer if necessary.

3. Oxygen Therapy:
   Supplemental oxygen may be necessary in the recovery room, particularly for patients who have undergone general anaesthesia. SpO_2 should be monitored, and oxygen therapy adjusted as necessary.

4. Pain Management:
   Pain management is an important part of post-anaesthesia care. Patients may experience varying degrees of pain following surgery, and effective pain relief is essential for patient's comfort and well-being. The type and dosage of analgesia will depend on the patient's medical history, surgical procedure, and PS. Pain score should be regularly assessed, and adjustments made as necessary. Patients who are prescribed PCA should be taught on how to use the equipment. Patients who are planned for epidural or peripheral nerve catheter infusions of LA should receive their infusions in the recovery room.

5. Nausea and Vomiting:
   Nausea and vomiting are common side effects of anaesthesia and surgery. Patients who are at risk of developing postoperative nausea and vomiting should be identified and managed appropriately.

6. Fluid and Electrolyte Management:
   Fluid and electrolyte balance should be carefully monitored and managed in the recovery room. Patients may require IV fluids to maintain hydration and electrolyte balance, particularly if they have undergone prolonged or complex surgery.

7. Temperature:
   Patient's temperature should be monitored, and adequate warming blankets and other active warming methods should be readily available for patients.

8. Discharge Criteria:
   Patients should only be discharged from the recovery room based on available standardised criteria which include stable hemodynamic, well-controlled pain, and proper handover to the attending ward staff.

9. These principles should be equally applied to other non-operating remote anaesthesia locations.

DESIGN FEATURES FOR THE RECOVERY ROOM

1. The recovery area should be part of the operating/procedural suite with easy access of patient transfer from the operation/procedure site. The minimum recovery bay to operation room ratio should be 1.5 to 1.

2. Ventilation of the recovery area should be at par with OT.

3. Each recovery bed must have:
    3.1. at least one oxygen outlet
    3.2. medical suction port and apparatus complying with operating room standards.
    3.3. at least two power outlets
    3.4. appropriate lighting and wall tone to allow accurate assessment of skin colour
    3.5. emergency lighting

4. The recovery area should include space for nursing station, utility room and storage for drugs, equipment, and linen. There must be appropriate facilities for scrubbing up for aseptic procedures. At least two telephones should be available for contacting medical staff in case of emergencies. Computers should be available to access online images, such as X-Rays or CT scans, and to review relevant blood investigations.

5. Provisions should be made for rapid evacuation of patients from the area in the event of an emergency.

EQUIPMENTS AND DRUGS

1. Each recovery bed space should have:
    1.1. oxygen flowmeter and humidified oxygen delivery systems
    1.2. suction equipment including a receiver, appropriate hand pieces (e.g. Yankauer) and a range of suction catheters
    1.3. the standard monitoring devices such as ECG, SpO_2, and NIBP.
    1.4. curtains that can be manoeuvred into place for patient's privacy when needed

2. Within the recovery area, this equipment must be made available:
    2.1. apparatus for manual ventilation with oxygen
    2.2. curtains that can be manoeuvred into place for patient's privacy when needed
    2.3. equipment and drugs for airway management and endotracheal intubation
    2.4. a range of IV equipment and fluids and a means of warming these fluids, e.g., warming cabinets
    2.5. drugs for acute pain management
    2.6. a range of syringes and needles
    2.7. patient warming devices

3. There should be easy access to:
    3.1. 12-lead ECG machine.
    3.2. resuscitation trolley with a defibrillator
    3.3. drugs for resuscitation and managing haemodynamic instability
    3.4. chest drains

3.5. warming cupboard
3.6. refrigerator for drugs
3.7. specialised refrigerator for storing blood and blood products
3.8. procedure light
3.9. basic surgical tray
3.10. ABG and electrolyte measurement
3.11. diagnostic imaging services
3.12. apparatus for mechanical ventilation
3.13. monitors for direct arterial and venous pressure monitoring
3.14. stethoscope
3.15. temperature monitoring device
3.16. IV poles
3.17. infusion pumps for drug delivery
3.18. an emergency call system

4. The recovery trolley/bed must:
   4.1. have a firm base with mattress
   4.2. be able to be tilted from one end with heads up and down at least 15° position
   4.3. be easily manoeuvrable
   4.4. have efficient and accessible brakes
   4.5. be able to be positioned for sitting up the patient
   4.6. have secure side rails which can be dropped below the base
   4.7. have provision for placement of apparatus for oxygen delivery and underwater seal drains during patient transport

STAFFING

1. The recovery area must be staffed at all times. The dedicated personnel must be well-trained in the care of patients recovering from anaesthesia.
2. A ratio of one recovery room staff to one patient who has not recovered protective reflexes or consciousness should be implemented. Otherwise, the ratio of recovery room staff to patients can range from one to a maximum of three awake and spontaneously breathing patients.
3. In the event of inadequate staff in recovery room, the attending anaesthetist should stay with the patient until the patient is fit for discharge.
4. A proper handover of patient must be practised during passing over of the patient care from the attending anaesthetist to the recovery room staff.

MANAGEMENT AND SUPERVISION

1. There must be established and documented routine for checking of the equipment and drugs in the recovery room.

2. A designated anaesthetic doctor should be stationed at or within the vicinity of recovery room area. The attending anaesthetist should be contactable at all times while the patient is still in recovery room.

3. For patients received in the recovery room:
   3.1. they have to be accompanied/transferred by the attending anaesthetist
   3.2. there must have written and verbal instructions to the recovery room staff
   3.3. a clear handover on the type of apparatus and the flow rate required for oxygen therapy
   3.4. a clear handover of site of arterial line and/or central line and the subsequent plan for these intravascular access on patient

4. Observations should be recorded at appropriate intervals and should include HR, NIBP, SpO_2, RR, PS, level of consciousness and temperature as appropriate.

5. Intravenous drugs or LA drugs prepared for the patient in the recovery room must be clearly labelled with patient's name, as well as the medication name and concentration.

6. All patients should be observed until they are considered safe to be discharged from the recovery area according to established criteria. This duty may be delegated to a dedicated anaesthetic doctor or a trained recovery room nurse who have been fully informed of the clinical state of the patient.

7. The surgeon or physician in-charge of the patient should be consulted when needed if the patient needs further acute management.

8. If the patient is discharged to a ward, the recovery room staff managing the patient must inform the ward of any specific management (e.g., infusion pump for certain drugs, or oxygen therapy) that is required for transfer.

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Admissions and Discharges for PACU

Associate Professor Dato' Dr Wan Rahiza Wan Mat, Dr Maryam Budiman, Dr Syarifah Noor Nazihah Sayed Masri

INTRODUCTION

Post Anaesthesia Care Unit is a unit located in the General OT complex and consists of three ventilated beds and a non-ventilated bed. The purpose of this guideline is to ensure appropriate admissions and discharges of patients to and from the PACU.

STAFFING OF PACU

1. The anaesthetic consultant/specialist on-call/in-charge is responsible for the PACU admission/discharge under the directive of the HOD of Anaesthesiology and Intensive Care, HCTM, UKM.
2. A rostered anaesthetic MO/specialist will be in-charge of PACU during office hours which is 0800H to 1600H, then the OT registrar/specialist on-call will take over from 1600H to 0800H the next morning.
3. The admitting anaesthetic doctor in PACU will notify the nurse in-charge of PACU of any proposed admission.
4. When the number of requests for admission exceeds the number of functioning PACU beds, the consultant/specialist in-charge is responsible to decide on the admission.

ADMISSION TO PACU

1. Requests for admission:
    1.1. PACU admits non-infectious patients postoperatively after elective or emergency operations carried out in the GOT.
    1.2. Only the consultant/specialist in-charge of the respective theatre can request for the PACU admission.

2. Booking a PACU bed:
    2.1. Elective operations are booked at least one day prior to the surgery by filling up the PACU booking form (Appendix A). The form is available at the PACU counter and the rostered MO/specialist will monitor the bookings.

2.2. All emergency bookings should be informed directly to the team in-charge of PACU (consultant/specialist/senior registrar). It should also be documented in the PACU booking form.

3. Criteria for admissions:
   3.1. Patient aged ≥ 12 years old and weigh > 20 kg is allowed to be admitted.
   3.2. Post-anaesthesia care that requires close observations and monitoring that cannot be provided in the wards.
   3.3. For stabilisation (that can be achieved within 24 hours) before more definitive transfer can be made either to HDS or relevant surgical discipline wards.
   3.4. Inclusive of:
      - Anticipated post anaesthesia complications that require intensive monitoring in order to provide immediate intervention.
      - Inadvertent perioperative complications that only require short and simple intervention; for example, but not limited to, hypothermia requiring further re-warming, blood loss intraoperatively requiring further fluid resuscitation.
   3.5. At present, all admissions require a negative COVID-19 RTK swab test within 36 hours (subject to change depending on condition).
   3.6. Patients planned for HDS care postoperatively following PACU discharge by the surgeons must have a confirmed bed in HDS prior to surgery. Such patients may be stabilised in PACU before being transferred to HDS.

4. Prioritisation:

1	Anticipated post-anaesthesia care requiring intensive monitoring and treatment that cannot be provided in HDS/HDU/ward. This includes ventilatory support, haemodynamic stabilisation and postoperative surgical monitoring for potential immediate surgical intervention.
2	Unanticipated/Inadvertent complication that occurred perioperatively in General OT requiring intensive monitoring and treatment postoperatively.

5. Inappropriate PACU admission:
   5.1. Patients who are able to be managed safely in HDS/HDU/ward post-operatively with low risk of anticipated complications.
   5.2. Patients that require critical care therapies for more than 24 hours.

5.3. Patients who were anaesthetised in the cardiac, cardiovascular lab, maternity, or peripheral OT; these patients should be transferred to CICU, CCU, or GICU directly from their respective OT.
5.4. Paediatric patients (aged < 12 years old) should be transferred to critical care units in Hospital Pakar Kanak-kanak, UKM.
5.5. Patients requiring less than 2 hours of stabilisation post anaesthesia should be monitored in the recovery area.
5.6. Preoperative stabilisation of a patient that requires ICU care should go directly to ICU prior to surgery in OT.
5.7. Patients pronounced dead on table or near death on table.
5.8. Patients with multidrug bacterial infection, transmissible diseases or having highly contagious infection.
5.9. Patients with infected open wound.

DISCHARGE CRITERIA

1. The anaesthetic consultant/specialist in-charge of PACU has to decide, by 24 hours of admission, on whether the patients can be discharged/transferred out from PACU.

2. The condition and progress of patients admitted to PACU should be reviewed continuously to identify patients who may no longer need PACU care.

3. The discharges during office hours (0800H to 1600H) must be discussed with specialist in-charge of PACU and the discharges after office hours must be discussed with specialist on-call OT.

4. Inclusive of:
   4.1. Stable physiological status
   4.2. Normothermia
   4.3. Stable haemodynamic parameters
      - IV inotropic/vasopressor support and vasodilators are no longer necessary or on low dose
   4.4. Stable respiratory function
      - Oxygen requirements not more than 60%
      - Return to baseline function
   4.5. Neurologically stable/ return to baseline
   4.6. Adequate analgesia with appropriate pain management
   4.7. Controlled postoperative nausea and vomiting

5. When a patient's physiological status is unstable despite PACU care after 24 hours, ICU transfer is mandatory.
    5.1. If GICU is full, the first available bed in GICU should be reserved for the patient.
    5.2. Incident reporting is required if PACU stay exceeds 24 hours.

6. All patients discharged from PACU must be recorded in the discharge forms (Appendix B) by the PACU MO.

INCIDENTS IN PACU

1. Medical officer is required to inform specialist in-charge (0800H to 1600H) or specialist on-call (1600H to 0800H) of any critical incidents in PACU e.g. re-intubation, cardiac arrest, etc.
2. Incident report form (Appendix C) must be filled and sent to the specialist in-charge to be filed in the department.

Appendix A

PACU BOOKING FORM **DATE: _____**

NO	Patient Name / MRN (sticker)	Anaesthetist	Discipline/ Surgeon	Diagnosis & Procedure	Indication for PACU	Planned or unplanned booking	Allowed (√) or not (x) booking	Reason booking not accepted/ Unplanned admission	Reason for cancellation

Appendix B

PACU Discharge Summary

Patient Identification Label	Date of admission: Time: Date of discharge: Time: Any delay in discharge: If yes, specify: Discharge to:	
Indication for PACU admission:	Diagnosis on admission in PACU:	
Procedure: Co-morbidities:		
Clinical Course in PACU:		
Pre-operative Investigation:	Discharge Investigation:	
Current Therapy:	Investigation to follow-up:	
Other recommendation:		
Medical Officer: Signature: Date:	Official stamp:	

Please carbon copy this form and keep a copy in the Discharge Summary folder in PACU

Appendix C

PACU Incident reporting Form

Date of incident	
Reported by	
Patient's Details	
Primary Diagnosis	
Secondary Diagnosis	
Procedure(s) Done	
Type(s) of Anaesthesia	
Complications/Incidents	
Management	
Outcome	**PACU/GICU/Ward/Others**

EXAMPLES OF REPORTABLE INCIDENTS / COMPLICATION IN THE RECOVERY ROOM

IN THE RECOVERY ROOM **

CVS	- Bradycardia / Tachycardia - Arrhythmias - Hypo or hypertension - Ischaemic event - Cardiac arrest
RESPIRATORY	- Hypoventilation - Desaturation - Laryngo /Bronchospasm - Aspiration - Re-In tubation
CENTRAL NERVOUS SYSTEM	- Agigation - Unresponsiveness
GASTROINTESTINAL	- Postoperative Nausea Vomitting (PONV) - Hypoglycaemia
GENITOURINARY	- Urinary Retention / Full bladder
PERIPHERAL	- Residual Paralysis / Poor Reversal - Hypothermia / Shivering
OTHERS	- Pain - Bleeding

** OR ANY INCIDENT THAT WARRANTS THE ATTENTION OF THE ANAESTHETIC DOCTOR IN CHARGE

REFERENCES

1. UK National Core Competencies for Post-anaesthesia Care. Immediate Post-anaesthesia Recovery. 2013 Supplement.
2. Phoebe S & Rachel C. Recovery and Post Anaesthetic Care. Anaesthesia & Intensive Care Medicine. 2009;10(12):576-579.
3. American Society of Anesthesiologists: Practice Guidelines of Postanesthetic Care. An Updated Report by the American Society of Anesthesiologists Task Force on Postanesthetic Care. Anesthesiology. 2013;118:291-307.

Clinical Services of Cardiothoracic Anaesthesia

Professor Dr Joanna Ooi Su Min, Dr Ahmad Fairuz Abdul Shokri, Dr Kanesh Kumar Doraisamy, Dr Mohammad Nizam Mokhtar

INTRODUCTION

The scope of cardiothoracic anaesthesia includes providing anaesthesia for adult and paediatric patients undergoing cardiac and thoracic surgery including video-assisted thoracoscopic surgery, diagnostic and interventional cardiac catheterization and intensive care support in the CICU.

DUTIES OF CARDIOTHORACIC ANAESTHESIA MEDICAL OFFICER

The CTC Anaes MO is expected to perform clinical duties related to Cardiothoracic Surgery Services in the OT and in CICU.

1. Preoperative assessment
    1.1. The CTC Anaes MO is expected to review patient planned for Cardiothoracic Surgery, Cardiology or Respiratory intervention under anaesthesia, at least a day before the planned surgery/procedure with consultation from the specialist/consultant-in-charge of the case.

2. Peri-operative (refer section "Protocol for Adult Open-Heart Cases")
    2.1. The CTC Anaes MO is responsible to check the GA machine prior to starting a case in the OT and is expected to prepare the anaesthetic and emergency drugs required for the case.
    2.2. Induction of anaesthesia.
    2.3. The CTC Anaes MO is responsible in escorting the patient to CICU at the end of surgery.

3. Post-operative
    3.1. The CTC Anaes MO is responsible of managing the patient's ventilator settings and sedation in CICU.
    3.2. The CTC Anaes MO will decide on the patient's readiness for extubation at the appropriate time.

3.3. The CTC Anaes MO will also attend to the patient when the patient requires Advance Life Support intervention (e.g., intubation, defibrillation, CPR).
3.4. In the event if CTC Anaes MO is not available in an emergency situation, help can be sought from RICU on-call temporarily.

PREOPERATIVE ASSESSMENT

Preoperative assessment will be done by the CTC Anaes MO in consultation with the specialist/consultant-in-charge of the case.

PROTOCOL FOR ADULT OPEN-HEART CASES

1. Drug preparation
    1.1. Anaesthetic agents
        - Midazolam 0.1 – 0.2 mg/kg
        - Fentanyl 5 – 10 µg/kg
        - Rocuronium 0.9 mg/kg
        - Etomidate (if available) 0.2 – 0.3 mg/kg
        - Sevoflurane for maintenance of anaesthesia
        - TCI technique (Remifentanil 3 – 8 ng/ml, Propofol 4 – 6 mcg/ml)
    1.2. Cardioactive agents
        - Phenylephrine
        - Ephedrine
        - Adrenaline
        - Dopamine
        - Dobutamine
        - Milrinone
        - Noradrenaline
        - Glyceryl trinitrate
        - Sodium nitroprusside
        - Calcium chloride
    1.3. Antibiotic prophylaxis
        - Please refer to HCTM, UKM Surgical Prophylaxis Guide 2018
    1.4. Anticoagulation and reversal
        - Heparin 300 – 400 units/kg (3 – 4 mg/kg) to achieve ACT > 400 seconds
        - Protamine 3 mg/kg body weight
    1.5. Antifibrinolytic agent
        - Tranexamic acid 2 g

2. Theatre sequence
    2.1. Routine checking of anaesthetic machine and airway equipment is performed according to the standard guidelines.
    2.2. Supplementary oxygen is given via nasal prong 2 L/min.
    2.3. Non-invasive monitoring (5-lead ECG, NIBP, SpO_2) is applied.
    2.4. Cerebral oximeter sensor may be applied if indicated.
    2.5. A large bore (14G/16G) peripheral IV line is inserted, and the radial artery (preferably) is cannulated under LA.
    2.6. Insertion of the CVC is done under LA prior to induction of anaesthesia in a high-risk patient. A pulmonary artery catheter may be inserted if indicated preferably via the right internal jugular vein.
    2.7. Antibiotics and tranexamic acid are given intravenously.
    2.8. Preoxygenation is followed by induction of general anaesthesia.
    2.9. The choice of induction agents is determined by the attending anaesthesiologist based on patient's condition. Intubation is performed when patient is fully paralyzed, and the ETT is secured.
    2.10. A temperature probe and urinary catheter is inserted and the patient is positioned accordingly.
    2.11. Transoesophageal echocardiography probe is inserted when indicated.
    2.12. Femoral artery cannulation using a 16 G angiocath 3.25 inches may be required in high risk patients in view of a need for intra-aortic balloon pump insertion.
    2.13. All monitored parameters and drugs given are charted.
    2.14. Ventilation is withheld temporarily to deflate the lungs prior to sternal opening.
    2.15. IV heparin (3 – 4 mg/kg) is given prior to commencement of CPB. ACT is checked after 3 minutes to achieve a value of > 400 seconds.

3. Pre-bypass anaesthesia check list

Heparin has been given and ACT > 400 seconds	☑
Aortic and venous cannulation successfully completed	☑
Priming fluid and pump flow are adequate	☑
All monitors functioning accurately	☑
Depth of anaesthesia is adequate	☑
Pupil size checked	☑
Pre-bypass fluid administered and urine output recorded	☑
Vasoconstrictors and vasodilators prepared	☑
IV fluids stopped	☑

3.1. The ventilator is only turned off when the patient is on CPB with satisfactory flow.

3.2. When on CPB, ABG is done regularly including during and rewarming, with special attention to gas exchange, serum electrolytes, haematocrit, random blood sugar and lactate levels. Alpha stat method of acid base balance is maintained (pH 7.4 and PCO_2 40 mmHg when temperature is corrected to 37°C).

3.3. During rewarming, additional hypnotics and narcotics are given via the CPB as required.

3.4. Just prior to the release of aortic cross clamp, Valsalva manoeuvre is performed to de-air the left heart. Upon releasing the aortic cross clamp, direct defibrillation may be required if the heart fibrillates. When epicardial pacing is required, VVI or DDD mode is used.

3.5. When the patient's temperature reaches 36.0 – 36.5°C, manual ventilation with 100% oxygen is commenced and ventilation is resumed.

3.6. Prior to termination of CPB, ensure the following.

- Patient's temperature is 36.0 – 36.5°C
- Ventilator is switched on and the appropriate alarms are activated
- FiO_2 is set at 1.0
- Ensure patient has adequate depth of anaesthesia
- Correct ABG and electrolyte imbalances as necessary and keep haematocrit > 20%

3.7. Inotropes, pacemaker and blood/blood products should be readily available.

3.8. When haemodynamically stable, the venous cannula is removed. IV protamine (3 mg/kg) is given slowly after a test dose and titrated according to the patient's blood pressure. Note: Protamine is not prepared until the patient is off bypass.

3.9. ACT is repeated and kept at ± 20 seconds of the preoperative value.

4. Postoperative period

4.1. Postoperatively, the patient is transferred to CICU.

4.2. In CICU, the patient is connected to the ventilator. IV morphine ± midazolam infusion and inotropes are continued. Alternatively, dexmedetomidine infusion may be used (maintenance dose: 0.2 – 0.7 mcg/kg/hr). ABG, other blood investigations and CXR are performed and reviewed.

4.3. If pump blood is given back to patient, an additional IV protamine (about 5 mg/100 ml) is given.

4.4. Weaning and extubation will be done accordingly.

OPEN THORACOTOMY OR VIDEOASSISTED THORACOSCOPY

One lung ventilation will be achieved using either the appropriate size disposable double-lumen tube or bronchial blocker, which are both available in our centre. Checking and confirming of position of the double-lumen tube will be done using a fibreoptic bronchoscope for all cases.

1. Choice of double-lumen tube
    1.1. Usually a left-sided double-lumen tube is used, except in surgery involving the left main bronchus where a right-sided double-lumen tube will be used.
    1.2. The choice of appropriate double-lumen tube size is guided by the patient's gender and height. However clinical discretion should be used when choosing the correct double-lumen tube size.

Gender	Height (cm)	Size (Fr)
Female	<150	32
	150-160	35
	>160	37
Male	<160	37
	160-170	39
	>170	41

2. Bronchial blocker
    2.1. The bronchial blocker that is readily available in HCTM is the Arndt endobronchial blocker [Size 5Fr (Paediatric) and 7Fr (Adult)].
    2.2. Indications of using bronchial blocker
        - Patients who are difficult to intubate.
        - Patients who are on tracheostomy tube.
        - Patients who are already intubated with an ETT.

REFERENCES

1. Department of Anaesthesia, National Heart Institute (Institut Jantung Negara), Malaysia. Protocol for Adult Open Heart Cases. 2009.
2. Slinger PD & Campos JH. Miller's Anesthesia (7th edition). Anaesthesia and Intensive Care. 2011;1:1835.

Paediatric Anaesthesia Services

Associate Professor Dr Rufinah Teo, Dr Wong Sze Meng

INTRODUCTION

The perioperative care of infants and children demands special facilities and presents a challenge for anaesthesiologists. The outcome of surgery and anaesthesia in children is closely related to the experience of the clinical team involved. It has been shown that an experienced surgical and anaesthesia team considerably decreases M&M in young children.

Children who undergo anaesthesia and surgery have special requirements. They are not small adults; they differ physiologically, emotionally and socially. Doses of drugs and fluids need to be calculated precisely and anaesthetic equipment for smaller children differs from that used in older children and adults.

ORGANIZATION AND ADMINISTRATION

1. There should be evidence-based guidelines and protocols relating to resuscitation, perioperative care, and the management of conditions such as anaphylaxis and MH, readily available.
2. All patients should be assessed before their operations by an anaesthetic doctor where both the parents/guardian/guardian and the child should be given the opportunity to ask questions.
3. All neonates sent to the OT and back to the ward should be transported in incubators in a thermo-neutral environment.
4. Parents/guardian should be involved in the care process. This includes physical and psychological preparation of the patient for surgery. A child-centred approach to anaesthesia and surgery should be employed such as provision for parents/guardian to accompany children, both to the anaesthetic room and into recovery areas. There may be exceptions to these; for example, anticipated difficulty in tracheal intubation or rapid sequence induction.
5. Arrangements should be in place with a specialised paediatric unit for the transfer of sick infants or children.

FACILITIES

1. The recovery area should be equipped with paediatric airway and resuscitation equipment.
2. Resident accommodation is available for parents/guardian of children who require overnight admission to hospital.
3. The appearance of the anaesthetic induction and recovery areas should consider the emotional and physical needs of children.
4. Parents/guardian should be allowed timely access to the recovery area or, if this is not feasible, children should be reunited with their parents or carers as soon as possible.

PATIENT INFORMATION/CONSENT

1. Although separate written consent for anaesthesia is not mandatory, there should be discussions with the child and/or parents/guardian about methods of perioperative anaesthetic management. Information should be given about the associated risks and side effects. There should be a written record of all discussion with the child and/or parents/guardian about methods of induction, and provision of postoperative pain relief (including the use of suppositories).
2. Where special techniques such as neuraxial blockade and regional blocks, invasive monitoring and blood transfusions are anticipated, there should be a written record that this has been discussed with the child or young person and/or their parents/guardian as appropriate.
3. In infants and children below 18 years of age, consent for medical and surgical treatment is obtained from the parent or the legal guardian.

STAFFING REQUIREMENTS

1. Anaesthesia in children should be undertaken or supervised by specialists or consultant anaesthesiologists who have relevant paediatric practice sufficient to maintain core competencies. The level of supervision of a trainee will vary according to their ability and experience, the complexity and location of the procedure, the presence of any relevant co-morbidity and the age of the patient.
2. When a child undergoes anaesthesia, the anaesthetic doctor must be assisted by an assistant with adequate experience.
3. In the period immediately following anaesthesia, the child should be managed in the recovery ward or critical care area by designated staff. The staff in this area should have paediatric experience and current paediatric competencies, including basic resuscitation.

OPERATING THEATRES

1. A full range of age appropriate monitoring devices, paediatric anaesthetic equipment and disposable items for MAC, general and regional anaesthesia should be available in theatres and all other areas where children are anaesthetised.
2. There should be appropriate thermostatic control of the operating room; temperature monitoring and patient warming devices should be available in both the operating room and recovery area.

PAEDIATRIC ANAESTHESIA EQUIPMENT AND DRUGS

There should be age and weight appropriate equipment available for application to the paediatric patient. These equipment should be easily accessible and well maintained.

1. Resuscitation Equipment & Drugs
   A resuscitation cart with equipment appropriate for paediatric patients of all ages, including paediatric defibrillator paddles, should be routinely available at all sites where children are to be anaesthetised. The anaesthesiologist should be educated in recognition of cardiac dysrhythmias, have equipment for accurate recording of abnormal cardiac rhythms, and know how to use defibrillators that can deliver paediatric doses of energy accurately. Resuscitation drugs should be available in appropriate concentrations. A written paediatric dose schedule for these drugs should be immediately available.

2. Anaesthetic machines should incorporate ventilators, which have controls and bellows permitting their use over the entire age range together with the facility to provide pressure-controlled ventilation.

3. Airway equipment for all ages of paediatric patients include:
   3.1. Ventilation masks, cuffed tracheal tubes with cuff pressure gauge, oral and nasopharyngeal airways and laryngoscopes with paediatric blades.
   3.2. A separate, fully stocked “difficult airway cart” containing specialised equipment for management of the difficult paediatric airway by a variety of techniques for airway control, ventilation and intubation including but not limited to video laryngoscopes, fibreoptic bronchoscopies and emergency cricothyrotomy sets.

4. Devices for the maintenance of normothermia should be made available (e.g., warming lamps, circulating warm-air devices, room thermal regulation capability, airway humidifiers and fluid-warming devices).

5. Intravenous fluid administration equipment including paediatric volumetric fluid administration devices, intravascular catheters in all paediatric sizes, and devices for intraosseous fluid administration.

6. Monitoring equipment include:
    6.1. Non-invasive monitoring equipment for the measurement of ECG, NIBP, SpO_2, capnography including but not limited to depth of anaesthesia monitoring device, anaesthetic gas concentrations, temperature and inhaled oxygen concentration.
    6.2. Invasive monitoring equipment for the measurement of arterial and central venous pressures in infants and small children.

SUPPORT SERVICES

1. Blood transfusion and diagnostic services should meet the requirements of neonates, infants and children. A massive transfusion protocol for children, should be in place.
2. Paediatric High Dependency and Intensive Care services should be available as appropriate for the type of surgery performed.
3. There should be pharmacy staff with specialized paediatric knowledge available to provide advice and ensure safe and effective management of drugs in children.
4. There should be a properly staffed APS which covers the needs of children and undergoes regular audit (Refer to Guidelines on Pain Management).

TRANSFER OF CRITICALLY ILL CHILD

1. In some circumstances, it may be necessary to provide an emergency transfer of a sick child who is intubated and ventilated. This may occur particularly in the case of a child who presents at a non-specialist paediatric tertiary centre and requires a time critical transfer e.g. for an acute neurosurgical emergency or major trauma. In these circumstances, the child will need to be accompanied by a staff with relevant competency.
2. There should be portable age appropriate monitors, transfer equipment (including a portable ventilator) and drugs readily available to transfer critically ill children.

TRAINING AND EDUCATION

All anaesthesiologists whether they are specialist paediatric anaesthesiologists working in specialized units or those with an interest in paediatric anaesthesia must recognize and work within the limits of their professional competence. They should participate in continuing medical education and workshops that are relevant to paediatric anaesthesia and resuscitation in order to maintain the skills that they acquired during their initial training.

RESEARCH AND AUDIT

1. Audit plays a vital role in the quality assurance process and in measuring performance. There should be departmental audit and M&M meetings relating to paediatric anaesthesia. Where appropriate, this should be multidisciplinary and incorporate input from parents, guardians and patients.
2. Audit activity should include the regular analysis of critical and untoward incidents. Serious events and near misses will need to be investigated thoroughly.
3. Anaesthesia research in children should be facilitated when possible and should follow strict ethical standards.

REFERENCES

1. Royal College of Anaesthetists. Guidelines for the Provision of Anaesthesia Services (GPAS). Chapter 10. Guidelines for the Provision of Paediatric Anaesthesia Services. 2023.
2. American Society of Anesthesiologists. Statement on Practice Recommendations for Pediatric Anesthesia. 2021.
3. The Federation of European Associations of Paediatric Anaesthesia: Recommendations for Paediatric Anaesthesia Services. 2004.

Labour Analgesia

Associate Professor Dr Azlina Masdar, Associate Professor Dr Nadia Md Nor, Dr Farah Hanim Abdullah

INTRODUCTION

Labour can be a painful and exhausting experience for many women. Fortunately, there are various analgesia options available that can help alleviate the pain and discomfort associated with labour. These options range from non-pharmacological interventions such as breathing techniques and massage, to pharmacological interventions such as opioids and neuraxial analgesia. The choice of analgesia option will depend on a variety of factors, including the woman's personal preferences, the stage of labour, and any medical or obstetric complications.

When considering analgesia options for labour, it is important to balance the benefits of pain relief with potential risks and side effects. For example, some pharmacological options may have adverse effects on the mother, such as nausea, vomiting, and hypotension. Additionally, some analgesic options may have potential effects on the foetus, such as respiratory depression or poor neonatal outcomes. Therefore, it is important for healthcare providers to be knowledgeable about the various analgesia options available, and to work closely with the woman and her support team to determine the most appropriate pain management plan for her individual needs.

The Department of Anaesthesiology & Intensive Care, HCTM provides labour analgesia services to parturient in the Labour Room. This is a 24-hour service provided by anaesthesiology trainees and specialists/consultants.

PURPOSE OF GUIDELINE

This clinical practice guideline aims to promote a standardised and safe approach to pain management during labour, and to aid healthcare providers in making informed decisions about the selection, administration and monitoring of analgesic interventions.

EPIDURAL LABOUR ANALGESIA

1. **Rule our contraindications to epidural blockade**
    1.1. Coagulation abnormalities:
        - Check the coagulation status **if the patient has preeclampsia**
        - Platelet count should be >100,000/µl or >100 x 10^9/L
        - Presence of anticoagulant.
    1.2. Sepsis – local or systemic.
    1.3. Severe haemorrhage and hypovolaemia from any cause.

2. Explanation to the parturient
    2.1. **The extent of explanation is often influenced by the parturient's condition (e.g., stage of labour, PS).**
    2.2. As far as possible, explanation should include the following:
        - The epidural procedure
        - Effects on mother and baby
        - Possible side effects e.g. itchiness, shivering, numbness, weak legs, difficulty in passing urine
        - Possible complications, including the rare ones e.g. epidural haematoma, epidural abscess, neurological complications.
    2.3. Obtain written consent from the parturient for epidural analgesia.

3. Preliminary check
    3.1. The following items should be checked and prepared before starting:
        - Resuscitation trolley, with resuscitation drugs and airway equipment
        - Emergency drugs (including Ephedrine and Naloxone ampoules)
        - Monitoring equipment: NIBP (mandatory); SpO_2 and ECG (optional, in selected cases e.g. maternal heart disease).
    3.2. A trained assistant should be available during the procedure and to monitor the parturient afterwards.

4. Before the epidural procedure
    4.1. Insert an IV cannula (18G) if this has not been done.
    4.2. Infuse with Hartmann's solution. Do not use dextrose-containing solutions. No volume preload is necessary prior to the procedure.
    4.3. Attach monitoring equipment (see above). Note the baseline reading.
    4.4. Position the patient sitting or lying lateral.
    4.5. Check the epidural equipment.
    4.6. If the parturient is on oxytocin infusion, discontinue **temporarily** the infusion during the procedure to minimise contractions.
    4.7. The procedure should be performed under aseptic technique – surgical

mask, scrubbed, sterile gloves and gown.

5. The epidural procedure
    5.1. Perform lumbar epidural at L2-3 or L3-4 interspace.
    5.2. Use an 18G Tuohy needle and a 20G epidural catheter.
    5.3. **Communicate with the parturient at all times during the procedure.** Get her to tell you when she is having a contraction. Wait until each contraction has eased off before proceeding, to reduce the risk of dural puncture.
    5.4. Identify the epidural space by means of loss of resistance to air or saline. The latter is preferred as the end-point is better appreciated.
    5.5. Insert the epidural catheter and leave 4 – 5 cm within the epidural space. Not more than 5 cm should be in the space to avoid lateral migration of the catheter through the intervertebral foramen, which may result in unilateral analgesia.
    5.6. Once the epidural catheter is in place, apply the 'Opsite' spray, secure it with clear occlusive dressing and micropore.

6. Test dose
    6.1. The objective of the test dose is to detect misplacement of the epidural catheter into the intrathecal space. It **does not** confirm correct placement of the catheter in the epidural space.
    6.2. Test dose with 3 ml of 2% lignocaine, will test intrathecal but not intravascular misplacement of the catheter.
    6.3. Signs of intrathecal injection: rapid onset (within 5 min) of:
        - Sympathetic blockade: warm extremities.
        - Sensory blockade: numbness of lower limbs.
        - Motor blockade: weakness of lower limbs.

7. Subsequent management
    7.1. Once the test dose is negative, inject a further 3 – 5 ml of 0.25% levobupivacaine or 0.2% ropivacaine.
    7.2. Test the sensory level of the block: during the first stage of labour, a block of up to T10 is usually adequate.
    7.3. **"Every dose is a test dose"**. Injection of LA should be done **slowly** after negative aspiration for blood or CSF, and **in small aliquots** of 3 – 5 ml.
    7.4. Fentanyl 50 µg may be added to improve the quality of block.
    7.5. If the parturient is having a contraction, do not administer the LA through the catheter. Wait until the contraction has eased off.
    7.6. Commence continuous epidural infusion or PCEA for maintenance of analgesia.
    7.7. Monitor maternal NIBP and HR every 5 minutes for 15 minutes after each top

up dose, then every 15 minutes for the first hour, and half-hourly thereafter. Record the vital signs in a dedicated form for obstetric labour epidural analgesia.

7.8. Foetal HR should be monitored either intermittently or by continuous CTG.

7.9. Stay with the parturient until her pain is controlled and she is haemodynamically stable. Treat any complications early and aggressively.

7.10. The parturient should never lie completely on her back to avoid aorto-caval compression. As labour progresses, the parturient should be propped up progressively to allow diffusion of LA to block the sacral fibres.

COMBINED SPINAL-EPIDURAL ANALGESIA

1. Combined spinal-epidural analgesia may be performed in parturient for immediate pain relief in established labour.
2. The epidural space is located in the usual manner.
3. Insert the spinal needle after locating the epidural space. Positive end-point includes a 'click' at dural puncture and appearance of CSF at the hub of the needle.
4. Drug for intrathecal injection: Levobupivacaine 2.5 mg or ropivacaine 2 mg ± fentanyl 15 – 25 mcg.
5. The epidural catheter is inserted after the spinal needle is removed.
6. No epidural bolus is needed if the patient is comfortable after the spinal.
7. If pain persists, administer 3 ml of 0.25% levobupivacaine or 0.2% ropivacaine via the epidural catheter.
8. Usually no further bolus is necessary after that.
9. Commence epidural maintenance of analgesia.

MAINTENANCE OF ANALGESIA

1. Patient Controlled Epidural Analgesia

1.1. Machine set-up for PCEA

Solution	0.1% levobupivacaine with 2 mcg/ml fentanyl	0.05% ropivacaine with 2 mcg/ml fentanyl
PCEA bolus dose	5 ml	10 ml
Lockout interval	15 min	10 min
Background infusion	5 ml/hr	10 ml/hr

2. Continuous Infusion: 0.05% ropivacaine with 2 mcg/ml fentanyl at 10 – 15 ml/hr.

3. Programmed Intermittent Epidural Bolus
   3.1. Machine set-up for PIEB:
      - Solution: 0.1% levobupivacaine with 2 mcg/ml fentanyl
      - Bolus dose: 5 ml every hour
      - Patient controlled bolus dose: 5 ml
      - Patient bolus lockout interval: 15 min
      - Background infusion: NIL

4. Test the level of block one- to two- hourly. If the block extends up to T8, reduce the infusion rates.

Important: Be contactable at all times. The staff nurse taking care of the parturient should know your name and contact details. Epidural top-up doses or adjustments in epidural infusion rates should only be done by the anaesthetic doctor after assessing the patient. If the management of the parturient is handed over to the anaesthetic doctor on call after office hours, this information should be relayed to the Labour Room staff as well.

POSSIBLE COMPLICATIONS

1. Dural Tap with PDPH (Appendix A).

2. Blood in Epidural Catheter
   2.1. Means to reduce likelihood of bloody tap:
      - Avoid inserting the catheter further than necessary (≤ 20-cm mark).
      - Flush 3 – 5 ml of saline through the epidural needle before inserting the catheter to “open up the space”.
   2.2. When frank blood is aspirated from an epidural catheter, withdraw the catheter mm by mm and flush with saline until the aspirate is clear.
   2.3. Once the catheter is devoid of blood, the catheter may be used, but with great care, making sure at all times that:
      - The catheter is aspirated prior to subsequent doses of LA
      - All doses are given in small increments
      - The parturient is carefully monitored for early signs of LA toxicity
      - Consider removing and re-inserting the catheter if blood persists in the catheter or doubt remains with regards intravascular placement
      - The same interspace can be used for catheter re-insertion.

3. Hypotension
    3.1. Rule out aorto-caval compression.
    3.2. Get the parturient to lie in the left lateral position.
    3.3. Re-check the blood pressure. Correct hypotension by rapid infusion of Hartmann's solution ± vasopressor (ephedrine 6 mg or phenylephrine 50 – 100 mcg per bolus)
    3.4. Administer oxygen by face mask.
    3.5. Check the level of the sensory block. Stop the epidural infusion if the block extends above T8.
    3.6. See also section on "Accidental (Total) Spinal".

4. Unilateral Analgesia
    4.1. Get the parturient to lie on the unblocked side and top up with 3 – 5 ml of 0.25% levobupivacaine, 0.2% ropivacaine or 2% lignocaine.
    4.2. Consider administering epidural fentanyl 50-100 mcg.
    4.3. If unilateral pain persists, withdraw the epidural catheter by 1 cm and administer another bolus dose. If the problem persists, the catheter can be withdrawn by 1 cm each time (until a minimum of 3 cm remains within the epidural space).
    4.4. Explain to the parturient and repeat the epidural procedure if this is ineffective.

5. Inadequate Analgesia
    5.1. Diagnose the reason for inadequate analgesia and treat accordingly:
        - Malpositioned epidural catheter: readjust or re-site epidural catheter.
        - Inadequate dose: administer 5 – 8 ml bolus of 0.25% levobupivacaine, 0.2% ropivacaine or 2% lignocaine. Increase infusion rate stepwise by 1 ml/h, if there is positive response to the bolus dose. Remember "Every dose is a test dose".
    5.2. Second stage of labour: administer a bolus of LA with the parturient in the semi- sitting position in order to block the sacral segments S2-4.

6. Inadvertent High Epidural Block
    6.1. This is due to an excessively large dose of LA in the epidural space.
    6.2. Clinical features:
        - Hypotension, nausea
        - Sensory loss or paraesthesia of chest and upper limbs (high thoracic or cervical nerve root block)
        - Difficulty in breathing due to intercostal muscle paralysis
    6.3. These symptoms can be very distressing and in severe cases may require

endotracheal intubation, while treating hypotension.

6.4. If the parturient is breathing adequately, she should be reassured and any hypotension treated immediately. Commence supplementary oxygen and SpO_2 monitoring, and be prepared to intervene if signs and symptoms deteriorate.

6.5. Difficulty in talking (small VTs due to phrenic nerve block) and drowsiness are signs of an excessively high block and should be managed emergently.

7. Accidental (Total) Spinal

7.1. This is due to inadvertent injection of epidurally administered drug into the subarachnoid space, either by unrecognised dural tap or intrathecal catheter migration.

7.2. Signs and symptoms:

- A rapid fall in blood pressure
- Ascending paralysis of the legs, trunk
- Respiratory difficulties
- Loss of consciousness

7.3. Treat symptomatically with full respiratory and cardiovascular support.

7.4. Perform rapid sequence induction with cricoid pressure, insert a cuffed ETT and assist ventilation.

7.5. Treat hypotension with fluids ± vasopressor.

7.6. Further management should be discussed with the obstetrician.

8. Local Anaesthetic Toxicity

8.1. This can occur as a result of an excessive dose of LA in the epidural space, or a moderate dose of LA injected intravascularly

8.2. Symptoms are preceded by light-headedness, tinnitus, circumoral tingling or numbness and a feeling of anxiety or “impending doom”, followed by confusion, tremor, convulsions, coma and cardio-respiratory arrest

8.3. To reduce the likelihood of LA toxicity:

- Carefully aspirate from the epidural catheter before administering LA
- Fractionate epidural doses into aliquots of 3 – 5 ml
- Be mindful of its clinical manifestations, recognize early and discontinue further administration of LA.

8.4. Management:

- Stop LA injection and call for help.
- Immediate management should focus on:
  - Airway management: Maintain the airway and intubate if necessary.
  - Give 100% oxygen and ensure adequate ventilation
  - Control seizures using benzodiazepine or propofol in small

incremental doses. **Avoid** propofol if having signs of cardiovascular instability

- Manage cardiac arrhythmias and assess cardiovascular status throughout

- Refer to the Department of Anaesthesiology & Intensive Care Clinical Practice Guidelines on Local Anaesthetic Toxicity
- Management of severe LA toxicity as per AAGBI guideline (Appendix B). The nearest lipid emulsion is located at the Maternity OT recovery room.

MANAGEMENT OF EPIDURAL AT LATE FIRST STAGE & SECOND STAGE OF LABOUR

1. Towards late first stage and second stage of labour, the parturient may complain of inadequate pain relief because the afferent fibres involved during the second stage are S2-4. Give a top-up with the parturient in the semi-sitting position in order to block the sacral segments.
2. The epidural infusion should be continued during the second stage of labour unless it is evident that the parturient is unable to bear down because of significant motor blockade.

EMERGENCY CAESAREAN SECTION

1. If emergency caesarean section is necessary, the parturient should be prepared in the usual manner (consent; Group, Screen and Hold; or Grouping and Cross-matching blood, gastric acid aspiration prophylaxis using IV ranitidine 50 mg stat, sodium citrate ± IV metoclopramide 10 mg).
2. Test the level of the block. If the epidural is functioning and the sensory block is at T10, administer 3 – 5 ml aliquots of 0.5% levobupivacaine or 0.75% ropivacaine to achieve a sensory block of T4 – T6 (usually a total of 10-15 ml is required). Add fentanyl 50 mcg epidurally to improve the quality of block.
3. In urgent cases where immediate caesarean section is warranted, administer 3 – 5 ml aliquots of 2% lignocaine (+/- adrenaline 1:200 000) in addition to fentanyl 50 mcg epidurally, to achieve a sensory block of T4 – T6 (do not exceed maximum limit of lignocaine).
4. If the epidural is not functioning, alternative methods of spinal anaesthesia or general anaesthesia should be considered depending on the suitability and urgency of the situation. Spinal anaesthesia following an epidural block should be used with caution because of the possibility of causing an inadvertently high block.

REMOVAL OF EPIDURAL CATHETER

1. At the end of delivery, the epidural catheter should be removed by the anaesthetic doctor before the parturient is sent to the ward. On removal, the tip of the epidural catheter should be inspected for integrity.
2. If caesarean section has been performed, postoperative analgesia may be provided using epidural morphine 3 mg diluted to 5 ml with saline. Remove the epidural catheter before sending the patient back to the ward. This is the preferred method of postoperative analgesia as it enables early ambulation.
3. If morphine is contraindicated, maintain epidural infusion of 0.2% ropivacaine with 2 mcg/ml fentanyl at 5 – 8 ml/hr (as per APS protocol).
4. Inform the APS team to review the parturient in the ward.

REMIFENTANIL PATIENT CONTROLLED ANALGESIA FOR LABOUR

1. Prerequisites
    1.1. Reserved for parturient whom epidural is contraindicated.
    1.2. During office hours only.
    1.3. Parturient in established labour.
    1.4. Continuous one-to-one midwifery care in the room **must** be available throughout labour.
    1.5. Parturient must be informed of the possible remifentanil side effects including drowsiness, pruritus, nausea, vomiting, dizziness, bradycardia, hypotension and respiratory depression, as well as neonatal respiratory depression.
    1.6. Neonatology team presence during delivery of the baby.
    1.7. Naloxone ampoule available at the labour analgesia trolley.
    1.8. Case must be discussed with specialist in charge of Maternity OT.

2. Contraindications to Remifentanil PCA
    2.1. Allergy to remifentanil (or other opioids)
    2.2. Less than 36 weeks gestation
    2.3. Pethidine or other opioid given in the preceding 4 hour
    2.4. BMI ≥ 35 kg/m^2
    2.5. OSA
    2.6. Twin pregnancy

3. Monitoring
    3.1. Continuous monitoring of parturient's level of consciousness. To call anaesthesia trainee in charge of labour room or on call if **Ramsay sedation score is 3 or more (not arousable to voice).**

3.2. Ramsay sedation scale:

Score	Response
1	Anxious or restless, or both
2	Cooperative, orientated and tranquil
3	Responding to commands only
4	Brisk response to stimulus
5	Sluggish response to stimulus
6	No response to stimulus

3.3. NIBP, HR, SpO_2, RR, sedation and PS are to be recorded every 10 minutes for the initial 30 minutes, and then every 30 minutes thereafter.
3.4. To call anaesthesia trainee in charge of labour room or on call if RR **less than 8 breaths per minute**.
3.5. Continuous SpO_2 monitoring.
3.6. Give supplemental oxygen either via nasal prong or simple face mask.
3.7. CTG as per obstetric team.
3.8. Anaesthesia trainee to review parturient after the PCA is discontinued.

4. Safety Points
4.1. Always use a dedicated IV cannula for remifentanil administration.
4.2. Do not give any other drugs via the PCA cannula.
4.3. Only the parturient is allowed to use the PCA demand button. The PCA demand button is not to be pressed by midwifery staff or the parturient's relative.
4.4. The PCA can be used during birth and for perineal repair.
4.5. Written informed consent **must** be obtained from parturient prior commencing PCA.

5. Remifentanil Preparation:
5.1. 1x remifentanil ampoule (5 mg), diluted with 100 ml 0.9% sodium chloride = 50 mcg/ml remifentanil (same dilution for OT usage). Take 10 ml of the 50 mcg/ml solution and further dilute with 40 ml 0.9% sodium chloride, to constitute in a 50 ml syringe 10 mcg/ml of remifentanil.
5.2. Inject this 50 ml of remifentanil 10 mcg/ml solution into a CADD Solis PCA cassette, vent out any air and attach to the anti-reflux tubing.
5.3. Prime the extension set (**do not** attach to parturient while priming).
5.4. Label the cassette as REMIFENTANIL 10 MCG/ML (final dilution).

6. The PCA Pump Preparation:
    6.1. Remifentanil 10 mcg/ml dilution (1 ml bolus = 10 mcg)
    6.2. Bolus dose: 20 – 40 mcg, depending on PS (start at 20 mcg/bolus, stepping up by 10 mcg every 15 minutes if inadequate pain relief)
    6.3. Lockout interval of 2 minutes
    6.4. **No** background infusion.

DOCUMENTATION / FOLLOW UP

1. The following forms need to be completed:

Epidural analgesia/Remifentanil PCA consent form	☑
Obstetric epidural analgesia record (observation chart)	☑
Epidural analgesia/Remifentanil PCA for labour audit form	☑

2. Parturient who received epidural analgesia/ remifentanil PCA should be followed up post-delivery. Besides getting feedback about her labour analgesia experience, the visit is part of total patient care and serves to enhance the image of the anaesthesiologist in the eyes of the general public.

Appendix A

PROTOCOL FOR THE MANAGEMENT OF ACCIDENTAL DURAL PUNCTURE

1. Preventive Measures
    1.1. Parturient receiving epidural analgesia or anaesthesia should be informed of the possibility of a dural tap and its consequences.
    1.2. During the epidural procedure, be mindful of the spine anatomy as you advance the epidural needle. Take the needle out and re-attempt if in doubt of needle site.
    1.3. Do not advance the needle if the parturient is having a contraction, as chances of a dural puncture is higher then. Wait for the contraction to ease off.

2. Immediate Action
    2.1. If a CSE technique is planned and the intrathecal medication has been drawn up, administer the dose through the epidural needle.
    2.2. Some of this medication will escape with the CSF outflow through the dural puncture, however, adequate amount should enter the subarachnoid space to provide initial analgesia.
    2.3. Subsequent management will require **discussion** with specialist in charge of MOT at the time.
    2.4. The decision to leave the intrathecal epidural catheter is at the discretion of the **specialist** in charge.
    2.5. Management of an intrathecal catheter as in subsection number 3 below.
    2.6. Alternatively, re-site the epidural in another space. If you do not think you can do it, seek senior assistance. Observe for an excessively fast onset or unusually extensive block (because of the previous dural puncture/tear).

3. Management of an Intrathecal Catheter
    3.1. Insert the epidural catheter and leave 3 cm within the subarachnoid space.
        - Do not advance the catheter further if you elicit pain or paraesthesia.
        - Clearly **label** the intrathecal catheter and ensure that subsequent doses are administered **only by the anaesthetist**.
    3.2. Administer levobupivacaine 2.5 mg with fentanyl 25 mcg for labour analgesia.
        - This can be flushed with saline 2 ml.
        - Expect to repeat intrathecal doses every 1 – 2 hr with doses ranging from 0.5 – 1.5 ml of 0.25% levobupivacaine.

4. Management During Labour
    4.1. All dural taps must be documented and reported to the specialist in charge.
    4.2. Explain to the parturient and assure her that pain relief can be provided. Subsequent follow-up and management should be outlined to the parturient.
    4.3. The obstetrician should be informed. The presence of a dural puncture does not require a change of plan for delivery.
    4.4. If caesarean section is required, administer 0.5 ml increments of 0.5% levobupivacaine or hyperbaric bupivacaine via the intrathecal catheter to achieve T4 – T6 block. Preservative-free morphine 0.1 mg can be administered intrathecal for postoperative analgesia.
    4.5. After delivery, the epidural catheter should be removed as usual.

5. Post-Delivery
    5.1. The mother should be followed up daily and more often if necessary. Explanation and encouragement should be given as needed.
    5.2. Do not enforce ~~a~~ prolonged inpatient stay, but if discharged, the mother should be instructed to return to the hospital if she develops any signs and symptoms of PDPH.
    5.3. Bed rest is of no prophylactic value but, in the presence of headache, mobilisation should be postponed pending definitive treatment.
    5.4. Oral fluids should be encouraged to ensure good hydration.

6. Management of PDPH
    6.1. Elicit the typical symptoms of PDPH:
        - Frontal or occipital headache
        - Exacerbated by movement or sitting upright
        - Relieved when lying flat
        - May be associated with neck ache, photophobia, diplopia, nausea and vomiting.
    6.2. PDPH must be distinguished from other conditions:
        - Tension headache, migraine, pre-eclampsia, meningitis, cortical vein thrombosis, intracerebral haemorrhage, subdural haematoma, intracranial tumour.
        - A history of dural puncture may be absent.
        - Magnetic resonance imaging (MRI) may be required to assist in the differential diagnosis.
    6.3. If the patient complains of headache, appropriate pain relief should be prescribed regularly. Start from the simple analgesics and step up to the stronger analgesics as necessary:
        - Paracetamol, Mefenemic Acid or other non-steroidal anti-inflammatory

drugs

- Narcotic analgesic only in severe cases.

6.4. If the mother is pain-free after 24 hours, she should be gradually mobilised, but discouraged from lifting or straining. Her progress should be checked daily.

6.5. If PDPH symptoms are severe and not abated with conservative treatment, the possibility of an epidural blood patch should be considered and discussed with the parturient.

7. Epidural Blood Patch

7.1. An epidural blood patch relieves symptoms and stops CSF leak and is therefore the definitive treatment.

7.2. It is not advisable to carry out the procedure if there is evidence of maternal sepsis, e.g. high spiking fever, significantly raised white cell count, toxic-looking patient.

7.3. The procedure should be explained to the patient and written consent obtained.

7.4. The procedure should be done by an anaesthetist specialist/consultant in the OT under aseptic conditions.

- The patient is placed in the upright or lateral position for the procedure. If the patient is having severe headache, she would prefer to be in the lateral position.
- Two operators are required: one (trainee) to withdraw blood and the other (specialist/consultant) to locate the epidural space and perform the blood patch.
- 15-20 ml of blood is withdrawn under aseptic condition from the antecubital vein.
- The epidural space should be located at the same interspace as the one where dural puncture had occurred.
- Once the epidural space has been entered, blood is injected slowly into the space.
- Stop the injection when the patient complains of backache, fullness at the back, or when the headache disappears.
- The patient is returned to the ward in supine or lateral position. She should remain in bed for the first 4 – 6 hours and then mobilised gradually. She should be advised to avoid bending or straining afterwards.
- Document, review and follow up the patient. A few may require a second epidural blood patch if symptoms recur on mobilisation.

Appendix B

AAGBI Safety Guideline

Management of Severe Local Anaesthetic Toxicity

1 Recognition

Signs of severe toxicity:

- Sudden alteration in mental status, severe agitation or loss of consciousness, with or without tonic-clonic convulsions
- Cardiovascular collapse: sinus bradycardia, conduction blocks, asystole and ventricular tachyarrhythmias may all occur
- Local anaesthetic (LA) toxicity may occur some time after an initial injection

2 Immediate management

- Stop injecting the LA
- Call for help
- Maintain the airway and, if necessary, secure it with a tracheal tube
- Give 100% oxygen and ensure adequate lung ventilation (hyperventilation may help by increasing plasma pH in the presence of metabolic acidosis)
- Confirm or establish intravenous access
- Control seizures: give a benzodiazepine, thiopental or propofol in small incremental doses
- Assess cardiovascular status throughout
- Consider drawing blood for analysis, but do not delay definitive treatment to do this

3 Treatment

IN CIRCULATORY ARREST

- Start cardiopulmonary resuscitation (CPR) using standard protocols
- Manage arrhythmias using the same protocols, recognising that arrhythmias may be very refractory to treatment
- Consider the use of cardiopulmonary bypass if available

GIVE INTRAVENOUS LIPID EMULSION
(following the regimen overleaf)

- Continue CPR throughout treatment with lipid emulsion
- Recovery from LA-induced cardiac arrest may take >1 h
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

WITHOUT CIRCULATORY ARREST
Use conventional therapies to treat:

- hypotension,
- bradycardia,
- tachyarrhythmia

CONSIDER INTRAVENOUS LIPID EMULSION
(following the regimen overleaf)

- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

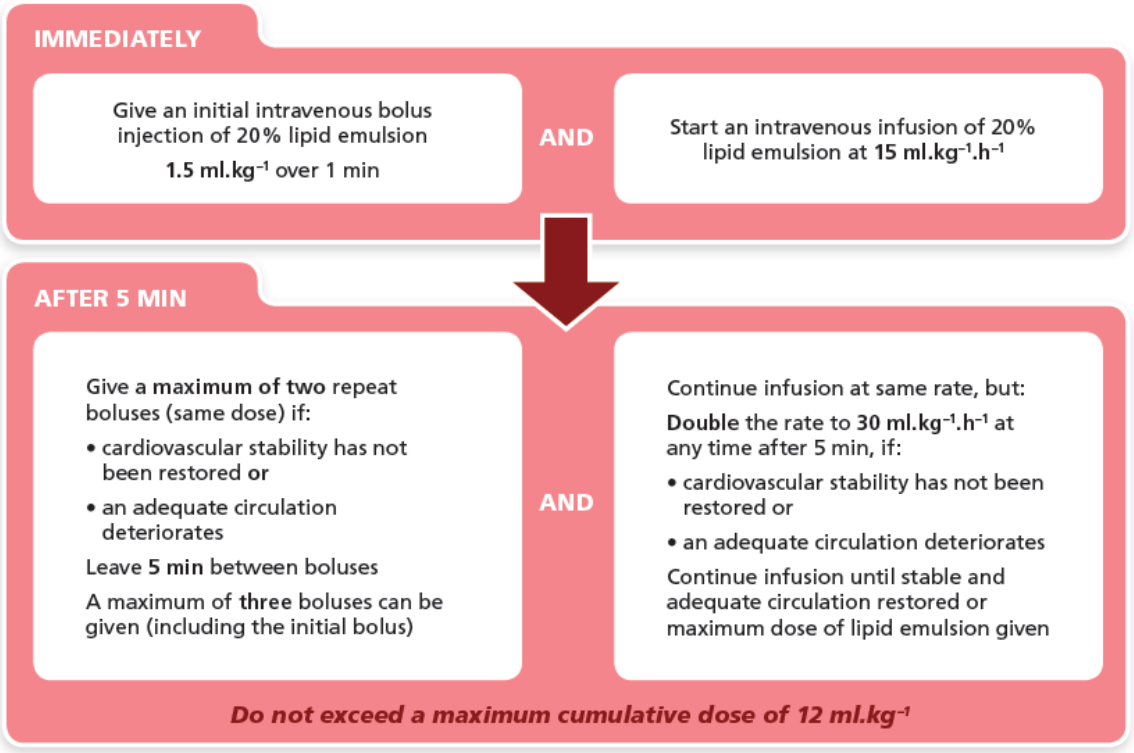
4 Follow-up

- Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved
- Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days
- Report cases as follows:
  in the United Kingdom to the National Patient Safety Agency (via www.npsa.nhs.uk)
  in the Republic of Ireland to the Irish Medicines Board (via www.imb.ie)

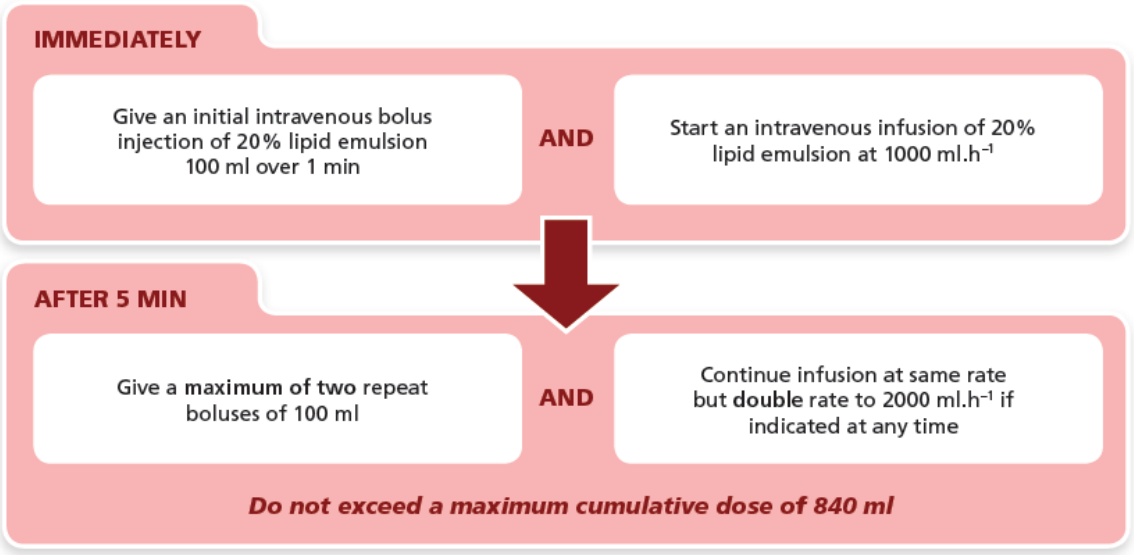
If Lipid has been given, please also report its use to the international registry at www.lipidregistry.org. Details may also be posted at www.lipidrescue.org

Your nearest bag of Lipid Emulsion is kept.....

Your nearest bag of lipid emulsion is kept at Maternity OT recovery room



An approximate dose regimen for a 70-kg patient would be as follows:



This AAGBI Safety Guideline was produced by a Working Party that comprised:
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This Safety Guideline is endorsed by the Australian and New Zealand College of Anaesthetists (ANZCA).

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Remifentanil Usage by Anaesthesiologists

Associate Professor Dr Muhammad Maaya, Dr Tan Kok Wang

INTRODUCTION

Remifentanil is a potent ultra-short acting **selective μ-opioid receptor agonist** and was first approved for use as an analgesic agent during anesthesia in 1996. Remifentanil is widely used in anaesthesia and conscious sedation. It is an ideal agent for those purpose because of its rapid onset and offset, as well as its synergistic effect with other general anaesthetic agents. It is a versatile drug that can be used in various anaesthetic and critical care situations.

USAGE

Remifentanil is solely for IV infusion.

1. Remifentanil is used as a component of TIVA, for induction and maintenance of general anaesthesia. TIVA is useful in;
    1.1. Previous history of MH or MH susceptible patients
    1.2. Procedures requiring neurophysiological monitoring, for example spine surgery, thyroidectomy, parotidectomy and mastoidectomy
    1.3. Neurosurgeries
    1.4. Microlaryngeal surgery e.g. laser surgery
    1.5. Thoracic surgeries
    1.6. Patients at the risk of post-operative nausea and vomiting.

2. Remifentanil is useful for procedural sedation and MAC. Examples of procedures that would benefit by using remifentanil are:
    2.1. Awake flexible scope intubation
    2.2. Bronchoscopy
    2.3. Gastrointestinal endoscopy
    2.4. Awake tracheostomy
    2.5. Intraoperative adjunct to regional block.

3. Remifentanil may be used as sedative and analgesic agent for mechanically ventilated patients in ICU.

4. Remifentanil can be considered in other areas as deemed necessary such as PCA remifentanil where epidurals are contraindicated.

CONTRAINDICATION

1. Absolute contraindication for use of remifentanil:
    1.1. Hypersensitivity to remifentanil and fentanyl analogue drugs.
    1.2. For epidural or intrathecal administration due to presence of glycine in the formulation

2. Relative contraindication for use of remifentanil:
    2.1. Bradycardia of less than 50 bpm
    2.2. Patients on vasopressor

SAFETY CONSIDERATION

1. Remifentanil should only be prepared and administered by a **trained anaesthetic doctor**. One should check and label the correct drug concentration after dilution.

2. **Minimal standard monitoring** (NIBP, ECG, SpO_2, and either capnography or respiratory impedance), resuscitation equipment and drugs must be readily available during remifentanil infusion. Implementing TIVA, the use of anaesthesia depth monitoring, for example, Bispectral index monitoring (BIS), is recommended.

3. Remifentanil must not be given as a manual bolus due to its high potency. **Continuous infusion** of remifentanil should be administered only via specific infusion device, either TCI pump or calibrated infusion device.

4. **A dedicated working IV access** is recommended for remifentanil infusion and should be accessible intra-operatively. The usage of a tubing with anti-reflux or anti-siphon capability is highly recommended to prevent backflow of remifentanil solution if the IV access is shared. Drug and fluid lines should be delivered as close as possible to patient to minimise dead space and avoid delay in response.

5. **Mixture of remifentanil and propofol** in the same syringe is not recommended due to different pharmacokinetic profile. Furthermore, remifentanil and propofol undergo separation and layering when mixed in a syringe resulting in varying remifentanil concentrations in different horizontal regions of the syringe.

6. The IV access must be flushed at the end of procedure to prevent inadvertent bolus that may cause respiratory depression, apnoea, and muscle rigidity.

RECONSTITUTION AND DILUTION PRIOR TO ADMINISTRATION

1. The reconstituted solution of remifentanil is **stable for 24 hours** at room temperature (25°C) with IV fluid listed below:
   1.1. Sterile water for Injection
   1.2. 5% dextrose
   1.3. 5% dextrose and 0.9% sodium chloride
   1.4. 0.9% sodium chloride
   1.5. 0.45% sodium chloride
   Exception for Ringer's lactate which is stable for only 4 hours.

2. Remifentanil 5 mg powder can be reconstituted with **5 ml** 0.9% normal saline resulting in **1 mg/ml solution** and further diluted into a concentration of 50 **µg/ml** for adults and **20 µg /ml** for paediatric patients as below:
   2.1. For **adult** patients: Dilute **5 mg** remifentanil in a volume of **100 ml** fluid (i.e. 100 ml 0.9% sodium chloride) resulting in concentration of **50 µg/ml.**
   2.2. For **paediatric** patients:
   - Dilute **5 mg** remifentanil in a volume of **250 ml** fluid resulting in concentration of **20 µg/ml.**
   - If a 250 ml fluid bottle is unavailable, dilute **5 mg** remifentanil into a volume of **100 ml fluid** resulting in concentration of **50 µg/ml**.
   - Then remove **20 ml (1 g)** from 100 ml and further dilute the 1 g remifentanil (**20 ml)** to a volume of **50 ml** (add 30 ml fluid to a 50 ml syringe) resulting in concentration of **20 µg/ml.**

3. All dilution must be labelled with concentration, date and time of reconstitution.

4. The reconstituted solution should be clear and free of residue prior to use.

DOSAGE

(Using Actual Body Weight)

1. Dosage scheme of remifentanil for adult patients

Usage	Target controlled infusion	Constant rate infusion	Single bolus	Comments
Induction of TIVA	2-4 ng/ml	0.5-1.0 µg/kg/min	Due to its high potency, boluses are not recommended	Administered over 60 secs
Maintenance of TIVA	1-8 ng/ml	0.1-1.0 µg/kg/min		-
MAC	0.5-2 ng/ml	0.05-0.2 µg/kg/min		Titrate in steps of 0.2 ng/ml
Sedation and Analgesia for Intubated and mechanical ventilated patients	-	0.05-0.5 µg/kg/min		-

*Adapted from Total Intravenous Anaesthesia (Pocket Reference-3rd Edition)

1.1. The current available TCI programme for remifentanil for adults is the Minto Model, with either target of plasma or effect-site concentration.

1.2. Elderly patients aged more than 65 years old may need lower dosage of remifentanil.

2. Dosage scheme of remifentanil for paediatric patients

Usage	Target controlled infusion	MASS rate infusion	Comments
Induction of TIVA	Spontaneous breathing: 1-2 ng/ml Intubated patients: 4-5 ng/ml	A bolus of 0.2-0.3 µg/kg. Then infusion at 0.1-0.2 µg/kg/min A bolus of 0.5-1.0 µg/kg. Then a mass rate infusion of 0.3-0.5 µg/kg/min	Administered over 60 secs
Maintenance of TIVA	Spontaneous breathing: 1-2 ng/ml Intubated patients: 3-8 ng/ml	0.05-0.2µg/kg/min 0.2-1.0 µg/kg/min	

*Adapted from Total Intravenous Anaesthesia for Paediatrics: A practical Guidebook (1st Edition)

2.1. Remifentanil delivery for children depends on the actual body weight.
- Weight **≥ 30** kg: Use Minto model with plasma or effect-site concentration
- Weight **< 30** kg: Use mass rate infusion

INCOMPATIBILITY

Non-specific esterases in blood and blood products may lead to hydrolysis of remifentanil. Thus, blood or blood products should not be given via the same IV access.

CRITICAL INCIDENTS, ADVERSE EFFECTS AND CONCERNS INVOLVING REMIFENTANIL

Any incident involving usage of remifentanil should be managed accordingly.

1. Hypotension: can be treated with IV fluids and/or vasopressors.
2. Bradycardia: can be treated with anti-cholinergics.
3. Respiratory depression or desaturation: oxygen support with manual ventilation, reduce or cease the infusion in a period may improve the respiration.
4. Muscle rigidity: resolution of muscle rigidity may occur after decreasing or discontinuing the infusion.

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Safe Use of Laser in Operating Theatre

Associate Professor Dr Rufinah Teo, Dr Mohammad Nizam Mokhtar

INTRODUCTION

The word LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. The Laser device is a source of non-ionising radiation because it does not carry enough energy to ionise atoms. Laser is characterised by two properties – monochromatism (a single wavelength) and low divergence (the light is beamed in one direction and almost in a parallel manner).

The following is the SOP on the safe use of laser in the OT. This document covers the safety aspects as well as the administrative management of health personnel and patients involved in the use of medical lasers.

AIMS

1. To adapt the Guidelines on Occupational Safety and Health Act 1994 (ACT 514) in compliance with amendment in 2022 by the Ministry of Human Resource Malaysia by virtue of ACT A168 with the insertion of Third Schedule.
2. To ensure and minimise the risk of health to staff and patients from laser radiation exposure in the OT.

RESPONSIBILITIES

1. Laser safety supervisor
    1.1. Laser Safety Supervisor assists in the local supervision to ensure local rules are implemented.
    1.2. Permitting laser operation where proper standard procedures are carried out.
    1.3. Reporting to LSO on any incidents or suspected incidents and arranging medical assistance for the involved staff.
    1.4. Ensuring enough protective eyewear are available for all staff.
    1.5. Ensuring new staff who are dealing with lasers receive proper instructions on safety measures.

1.6. Ensuring documentation relating to the use of laser is completed.

2. Laser safety officer
    2.1. Ensuring that all employees, doctors, contractors/visitors comply with the laser safety policy with applicable standards and regulations.
    2.2. Enforcement of laser safety policies and procedures.
    2.3. Investigation of all laser-related incidents and malfunctions and making recommendations for remedial and preventative action.
    2.4. Ensuring appropriate training and education is provided to the employees.
    2.5. Conducting regular safety surveys to detect equipment problems or any trends toward a decrease in level of safety.

GENERAL PROCEDURES

1. General
    1.1. Personnel in the laser-controlled area are approved by the LSO and aware of all necessary laser safety precautions.
    1.2. Appropriate protective eyewear and PPE are worn by all personnel during laser use.
    1.3. Operator/user manual, facility policy and procedures are readily available in the laser controlled area.

2. Warning signs and visual indicators
    2.1. Laser warning signs are placed at all entrances to the laser room, when laser is in use and should be removed when the laser procedure is completed.
    2.2. Appropriate laser goggles should be placed outside the OT for any personnel that wish to enter.

3. Eye Protection
    3.1. CO_2 Laser – patient's eyes and face must be covered with saline soaked gauze; awake patients should be offered appropriate goggles.
    3.2. Nd:YAG Laser – eyes should be covered with oval gauze with overlying filtering lenses; awake patients can wear protective goggles appropriate to the wavelength of the laser.

4. Personnel Eye Protection During Surgery
    4.1. CO_2 Lasers – clear goggles with side shields. Optical density of 5.0.
    4.2. Argon Lasers – amber goggles or glasses with side shields. Optical density of 4.5.

4.3. Nd:YAG Lasers – green filtered goggles or glasses with side shields. Optical density of 4.0.

5. The Laser User
    5.1. Laser operator must be trained in using laser as damage to normal tissue can be due to overshoot or deflection of laser beam or malalignment of aiming and vaporizing beams.
    5.2. Laser operator ensures clear communication with the assistants and anaesthetist.
    5.3. Laser operator ensures the environmental and procedural control measures are in place.
    5.4. Laser operator need to select the appropriate laser parameters for the procedure.
    5.5. Laser operator must report any unusual events and safety concerns to the LSO.

MANAGEMENT OF AIRWAY FIRES

1. Primary Emergency Care:
    1.1. Immediately discontinue oxygen administration
    1.2. Removal of ETT
    1.3. Flood the field with saline or water.

2. Secondary Emergency Care:
    2.1. Insert an oropharyngeal airway and ventilate via face mask
    2.2. Avoid oxygen rich environment
    2.3. Perform immediate bronchoscopy to evaluate extent of injury to the tracheobronchial tree
    2.4. Remove fragmented mucosa and debris.
    2.5. Re-intubate, or perform low tracheostomy if airway oedema is severe or injury is extensive.

3. If fire is not out:
    3.1. Theatre staff should use a carbon dioxide extinguisher without delay, whilst another team member activates the fire alarm.
    3.2. If the situation remains unsafe for the patient or staff, the theatre should be evacuated, and a full fire-drill implemented.

4. Subsequent management
    4.1. Overnight observation is necessary even if there is no evidence of damage on bronchoscopy.
    4.2. Patient should be preferably placed in reverse isolation rooms (in positive pressure isolation to prevent staff/visitors from infecting the patient) and closely monitored for features of airway compromise.
    4.3. Consider antibiotics and short-term steroid.
    4.4. Provide oxygen supplementation in the form of humidified gases.
    4.5. If mechanical ventilation is indicated, add PEEP to intermittent positive pressure ventilation; aim for early weaning off the ventilator.
    4.6. Send tracheal aspirate for culture and sensitivity.
    4.7. Perform bronchoscopy 3 – 5 days later to reassess the extent of injury.

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Anaphylaxis in Operating Theatre

Dr Liu Chian Yong, Dr Iskandar Khalid

INTRODUCTION

Anaphylaxis is a severe and potentially life-threatening emergency which involves IgE mediated or direct release of vasoactive substances from mast cells and basophils with or without exposure to an antigen. Estimated incidence of perioperative anaphylaxis is 1 in 10,000 – 20,000 anaesthetic procedures. Early recognition and prompt administration of adrenaline in adequate dosage and aggressive volume replacement is the mainstay in the management of anaphylaxis.

DIAGNOSIS OF ANAPHYLAXIS

1. Anaphylaxis is a clinical diagnosis with various presenting symptoms and signs (Table1). Measurement of blood MCT levels may help to support the diagnosis.
2. Anaphylaxis should be considered in any cases of unexplained hypotension, unexplained cardiac arrest or unexplained difficulty in ventilation or bronchospasm. Cutaneous signs may be absent if circulation is compromised.

Table 1: Clinical signs of anaphylaxis

Mucocutaneous	Hives, flushing, erythema, urticaria, angioedema
Respiratory	Dyspnoea, wheeze, stridor, high airway pressures
Cardiovascular	Hypotension, tachyarrythmias, bradyarrhythmias and cardiac arrest

IMMEDIATE MANAGEMENT

1. Call for help. Note the time. Stop the surgery or procedure as soon as possible.
2. Remove all potential causative agents and maintain anaesthesia, if necessary, with an inhalational anaesthetic agent.

2.1. Common causative agents: antibiotics, neuromuscular blocking agents, patent blue dyes, chlorhexidine (including impregnated venous catheters), IV colloids and latex.

3. Apply the CAB approach (Circulation, Airway, Breathing) in initial resuscitation.
   3.1. If in cardiac arrest, pulseless electrical activity or systolic blood pressure < 50 mmHg, immediately start CPR as per ACLS protocol.
   3.2. If hypotensive, elevate the patient's legs and secure large bore IV access as soon as possible. Administer fluid bolus of 500 – 1000 ml for adults or 20 ml/kg for children using saline 0.9% or Hartmann's solution.
   3.3. Maintain the airway and administer 100% oxygen. Intubate the trachea if necessary.
   3.4. In addition to standard monitoring, invasive blood pressure monitoring should be considered, if not already present, to allow better titration of adrenaline and other vasoactive drugs.
   3.5. Consider insertion of a CVC to facilitate administration of inotropes and vasopressors.

4. Administer parenteral adrenaline as soon as possible (Table 2).

Table 2: Parenteral adrenaline dosing

IV adrenaline bolus	
Adult	50 – 100 µg (0.5 – 1 ml of 1:10,000 solution)
Child	1 µg/kg (0.1 ml/kg of 1:100,000 solution)
IM adrenaline bolus: if no IV access or hemodynamic monitoring	
Adult	500 µg (0.5 ml of 1:1000 solution)
Child 6-12 years	300 mcg (0.3 ml of 1:1000 solution)
Child <6 years	150 mcg (0.15 ml of 1:1000 solution)

   4.1. Consider starting infusion of IV adrenaline if the patient remains hypotensive despite three boluses of IV adrenaline.
   4.2. Adult: 3 mg adrenaline in 50 ml saline. Commence at 3 ml/hour (3 µg/min). Titrate up to 40 ml/hour (40 µg/min).
   4.3. Child: 1 mg adrenaline in 50 ml. Commence at 0.3 ml/kg/hour (0.1 µg/kg/min). Titrate up to 6 ml/kg/hour (2 µg/kg/min).

SECONDARY MANAGEMENT

1. Refractory hypotension despite IV adrenaline infusion.
    1.1. Consider transthoracic or transoesophageal echocardiography to look for potential causes of hypotension and optimize fluid therapy.
    1.2. Consider additional IV fluid boluses up to 20 – 40 ml/kg.
    1.3. Consider addition of an alternative IV vasopressor:
        - Noradrenaline:
            - Adult: 3 – 40 µg/min (0.05 – 0.5 µg/kg/min)
            - Child: 0.15 mg/kg in 50 ml run at 2 – 40 ml/hour (0.1 – 0.2 µg/kg/min)
        - Vasopressin:
            - Adult: bolus 1 – 2 units then 2 units/hour
        - Consider IV glucagon in beta-blocked patients unresponsive to adrenaline.

2. Refractory bronchospasm:
    2.1. Consider and treat other causes of high airway pressures including endobronchial intubation, circuit malfunction, airway device malfunction and pneumothorax.
    2.2. Administer salbutamol via metered-dose inhaler (100 µg/puff):
        - Adult or child > 6 years old: 12 puffs (1200 µg)
        - Child < 6 years old: 6 puffs (600 µg)
    2.3. Consider IV salbutamol:
        - Adult: IV bolus 100 – 200 µg then infusion 5 – 20 µg/min
        - Child: 0.5 – 1 µg/kg/min (maximum 20 µg/min)
    2.4. Consider IV magnesium sulphate 50 mg/kg (Adult 2 g over 20 mins).

3. Consider IV hydrocortisone for refractory reactions or ongoing bronchospasm or shock:
    3.1. Adult: 200 mg
    3.2. Child 6 – 12 years: 100 mg
    3.3. Child 6 months – 6 years: 50 mg
    3.4. Child < 6 months: 25 mg

4. Consider IV chlorpheniramine for mucocutaneous symptoms and signs:
    4.1. Adult: 10 mg
    4.2. Child 6 – 12 years: 5 mg
    4.3. Child 6 months – 6 years: 2.5 mg
    4.4. Child < 6 months: 250 µg/kg

POST CRISIS MANAGEMENT

1. Consider whether to proceed or postpone the surgery or procedure.
2. Close monitoring for at least 6 hours in mild cases. In moderate to severe cases consider ICU monitoring as anaphylaxis may persist beyond 24 hours and there is a 20% incidence of biphasic reactions.
3. Confirmation of anaphylaxis diagnosis.
    3.1. An acute elevation of serum MCT level is supportive of the diagnosis of perioperative anaphylaxis.
    3.2. MCT levels typically peak at about 15 to 120 minutes after onset of the reaction. A sample should be taken ideally within 60 minutes of the event, with 2nd and 3rd samples repeated at 4 hours and more than 24 hours post-event.
    3.3. MCT testing is currently unavailable in HCTM, hence liaison should be made with the laboratory or Institute of Medical Research before proceeding with the test.

FOLLOW-UP

1. Identification of causative agent
    1.1. The anaesthesiologist who administered the anaesthesia is responsible for ensuring that the patient and next-of-kin is informed of the incident and the reaction is properly investigated.
    1.2. Referral to identify potential causative agent(s) can be made to the HCTM Allergy Centre or HKLAAC. HKLAAC was established in 2014 and the first of its kind in Malaysia to assess perioperative anaphylaxis.

Contact details of HKLAAC
Anaesthetic Allergy Clinic, Department of Anaesthesia and Intensive Care, HKL
Tel: 03-26155555 (ext 1133/1134)
Fax: 03-26913815
Email: hklaac@gmail.com

    1.3. The anaphylaxis incident should be documented clearly in the patient's case notes for future reference.

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Latex Allergy in Operating Theatre

Associate Professor Dr Azarinah Izaham, Dr Ahmad Fairuz Abdul Shokri

INTRODUCTION

Natural rubber latex is the milky sap from the rubber tree, *Hevea brasiliensis.* The protein portion is responsible for Type I IgE-mediated hypersensitivity which can lead to anaphylaxis. Manufacturing latex rubber from this raw material involves addition of many chemicals that give latex its elasticity, and these cause Type 4 (cell mediated) contact dermatitis. Incidence of latex allergy in general population with no risk factor is < 1%. However, repeated exposure over time increases the incidence of sensitivity.

IDENTIFICATION OF AT RISK GROUPS

1. Patients who are at risk for latex allergy include:
    1.1. Repeated exposures to latex: Healthcare workers, multiple surgeries, repeated bladder catheterization
    1.2. Associated food allergies (due to cross-sensitization): Banana, avocado, chestnut, kiwi fruit, tomatoes, potatoes, stone fruits
    1.3. History of anaphylaxis with no identified provoking agent
    1.4. Medical conditions with increased predisposition for latex sensitization
        - Spina bifida
        - Urogenital/anorectal abnormalities
        - Tracheoesophageal fistula
        - Multiple congenital anomalies
        - Ventriculoperitoneal shunt
        - Quadriplegia/cerebral palsy
        - Preterm infants
        - Atopic individuals.

2. The above high-risk groups without a history of latex sensitivity will need no special precautions, but a high index of suspicion.

	TYPE 1 HYPERSENSITIVITY	TYPE 4 HYPERSENSITIVITY
Clinical features	Urticaria (local or generalised), bronchospasm, hypotension, rhinoconjunctivitis, angioneurotic oedema, anaphylaxis, and death	Contact dermatitis
Onset	Usually 20-60 minutes after induction (delayed anaphylactic reaction)	12-48 hours after contact
Test	Confirmed by: • Positive skin prick test (1% false negatives and anaphylaxis is a risk of testing) • Radioallergosorbent test (10-45% false negatives)	Patch testing
Causative agent	Due to latex proteins	Minority due to latex proteins, majority due to other compounds used in rubber manufacture
Incidence	Rare	Common

3. Routes of Exposure:
    3.1. Skin via gloves, dressings, urinary bags
    3.2. Inhalation of latex particles
    3.3. Intravascular via latex ports in IV drip sets
    3.4. Mucous membranes via contact with gloves, orifice examination
    3.5. Internal organs during surgery

MANAGEMENT OF PATIENTS WITH KNOWN/SUSPECTED TYPE 1 HYPERSENSITIVITY TO LATEX

1. Avoidance of contact with latex is of paramount importance.
2. On arrival to theatre, patients should have a "LATEX ALLERGY" sign to avoid direct contact with latex gloves. Healthcare staffs who are involved with the patient should be made aware of patient's allergy to latex.
3. Prophylaxis drugs (e.g. steroids, chlorpheniramine) are controversial and will not reliably prevent an allergic reaction although it may lessen the severity. It may however make the reaction harder to recognise and mask the early signs.
4. A latex-free environment must be maintained not only in theatre but in recovery and the ward.
5. Put the patient first on the theatre list or use a theatre that has not been occupied for 1 – 2 hours, to reduce the level of latex particles in the atmosphere. Theatre with laminar flow is ideal.
6. Do not use latex gloves during the preparation of the OT, as it may contribute to airborne latex particles.
7. Remove all latex products from the theatre including gloves or any anaesthetic or surgical equipment that may contain latex.
8. Put a "LATEX ALLERGY" warning sign on the door of the OT.
9. Resuscitation drugs should be readily available.
10. Consider monitoring the patient in the theatre during the recovery period.
11. Patients should be monitored post-operatively for a minimum of 1 hour.
12. Patients should be managed in isolation room during their stay in the ward to minimise exposure, with a clear "LATEX ALLERGY" notice on the door.
13. Patients are encouraged to self-educate on their latex allergy condition by looking at any hospital patient information page for patients with latex allergy which is readily available online. Example: https://www.mountsinai.org/health-library/selfcare-instructions/latex-allergies-for-hospital-patients#:~:text=If%20you%20have%20a%20latex,do%20not%20touch%20your%20skin

CONTENT OF LATEX FREE EQUIPMENT BOX

1. Warning sign "LATEX SENSITIVITY" or "LATEX ALLERGY"
2. Sterile gloves
3. Non-sterile gloves
4. Face masks
5. Guedel airways
6. Laryngeal Mask Airways

7. Endotracheal tubes
8. Breathing circuits
9. Re-breathing bags
10. Heat and moisture exchanger
11. Syringes
12. Cannulae
13. Fluid administration sets
14. Central venous catheter
15. Three-way taps
16. Resuscitation fluids
17. Spinal and epidural needles
18. Nerve block needles
19. ECG leads
20. NIBP cuff
21. Pulse oximeter
22. Pressure transducers
23. Tapes

NB: Drugs in glass or plastic ampoules are safe.
Drugs available with latex-free stopper: Thiopentone, Ketamine, Rocuronium, Hydrocortisone, Cefuroxime, Dantrolene

SYMPTOMS IN ANAESTHETISED PATIENTS WITH UNKNOWN LATEX HYPERSENSITIVITY

1. Tachycardia
2. Hypotension
3. Urticaria
4. Flushing
5. Facial edema
6. Laryngeal edema
7. Bronchospasm
8. Cardiorespiratory arrest

MANAGEMENT OF SUSPECTED LATEX ALLERGY REACTION

1. Does not differ from other allergic reactions.
2. Principles of management are as laid out in the Clinical Practice Guidelines for Anaphylaxis in Operating Theatre.

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Malignant Hyperthermia

Associate Professor Dr Muhammad Maaya, Dr Teng Hung Xin

INTRODUCTION

MH is a very rare pharmacogenetic disorder manifested as severe hypermetabolic reaction towards triggering agents during general anaesthesia. Most commonly, individuals who are susceptible to MH are autosomal dominant and have a mutation of ryanodine receptor type 1 (RYR1) that affects myoplasmic calcium regulation.

Mortality due to MH was once reported to be as high as 80% in the 1960s. With increased awareness of MH and prompt implementation of appropriate treatment which includes the availability of dantrolene, the mortality rate has dropped drastically.

CLINICAL FEATURES & DIAGNOSIS

Early recognition of an impending MH crisis and its immediate treatment is essential for the patient's survival. As the clinical signs associated with MH are non-specific, anaesthesiologists must be able to recognize a spectrum of features related to hypermetabolism in order to make a rapid diagnosis. The onset and progress of MH is variable ranging immediately to a few hours after administration of triggering agents, namely volatile anaesthetic agents and succinylcholine.

Additionally, it is worthwhile mentioning that MH-susceptible patients may have other presentations during peri-operative period that should raise the suspicion of progression to MH. These include muscle rigidity most evident in the jaw muscles immediately after administration of succinylcholine and rhabdomyolysis, usually postoperatively.

Although there are no criteria for diagnosis of MH, presence of cardinal features as below and exclusion of alternative causes is sufficient to call for the diagnosis of MH and instigate treatment.

Diagnostic features of MH

- Unexplained, unexpected increase in $ETCO_2$
- Unexplained, unexpected tachycardia
- Unexplained, unexpected increase in temperature

1. Early features
    1.1. Metabolic
        - Inappropriately elevated CO_2 production (raised $ETCO_2$ on capnography, tachypnoea if breathing spontaneously) – earliest sign of MH
        - Increased O_2 consumption
        - Desaturation
        - Progressive respiratory and later metabolic acidosis
        - Hot, flushed and sweaty skin (skin mottling in children)
    1.2. Cardiovascular
        - Inappropriate tachycardia
        - Cardiac arrhythmias (especially ectopic ventricular beats and ventricular bigeminy)
        - Unstable arterial pressure
    1.3. Musculoskeletal
        - Masseter muscle spasm (if succinylcholine is used)
        - Generalized muscle rigidity unresponsive to non-depolarising muscle relaxant

2. Late features
    2.1. Hyperkalaemia
    2.2. Generalised muscle ache (in an awake patient)
    2.3. Increase in core body temperature (0.5°C per 15 minutes)
    2.4. Rhabdomyolysis
        - Grossly elevated blood creatine phosphokinase levels
        - Grossly elevated blood myoglobin levels
        - ‘Cola’ dark-coloured urine due to myoglobinuria
        - Compartment syndrome
    2.5. Disseminated intravascular coagulation
    2.6. Acute kidney injury
    2.7. Severe cardiac arrhythmias and cardiac arrest

DIFFERENTIAL DIAGNOSIS

1. Insufficient anaesthesia, analgesia, or both
2. Infection or septicaemia
3. Insufficient ventilation or fresh gas flow
4. Anaesthetic machine malfunction
5. Anaphylactic reaction
6. Phaeochromocytoma
7. Thyroid crisis
8. Cerebral ischaemia, intracerebral infection or haemorrhage
9. Neuromuscular disorders
10. Elevated $ETCO_2$ due to laparoscopic surgery
11. Ecstasy or other dangerous recreational drugs
12. Neuroleptic Malignant Syndrome
13. Serotonin syndrome

MANAGEMENT

Prompt action in management of MH lowers the severity of complications and mortality.

Principles of management of MH

1. Reverse MH process
    - Eliminate the triggering agent
    - Administer dantrolene sodium
    - Commence active body cooling
2. Treat the consequences of MH

1. Immediate management

1.1. Declare an emergency & call for help. Quickly retrieve the MH trolley from the corridor outside Anaesthesia Biomedical Room (Appendix A).

1.2. Eliminate all triggering agents

- Turn off and remove vaporizer. Do not waste time changing the circuit/anaesthetic machine.
- Give 100% oxygen at maximum flow.
- Increase minute ventilation to 2 – 3x normal volume.
- Insert activated charcoal filters on inspiratory and expiratory limbs of circuit (if available).

1.3. Inform the surgeon and either abandon or complete the surgery as soon as possible.
1.4. Maintain anaesthesia with IV agents/non-trigger anaesthesia [e.g. TIVA with propofol infusion, targeting plasma/effect site concentration of 2.5 – 6 µg/ml (adult) or plasma concentration of 2.5 – 4 µg/ml (paediatric); and muscle relaxation with non-depolarising neuromuscular blocking agent].
1.5. Establish good IV lines with wide-bore cannulae.

2. Administer dantrolene sodium as soon as possible

2.1. 20 mg per vial reconstituted with 60 ml of sterile water, which require 5 minutes of vigorous shaking (preparation takes time and requires at least a dedicated personnel); or
2.2. Ryanodex – 250 mg per vial rapidly dissolved in 5 ml of sterile water (if available).

Dantrolene sodium administration

1. Dose: 2.5 mg/kg* immediate IV bolus
2. Repeat 1 mg/kg* every 5 minutes until
   - Reduction of $ETCO_2$ to < 45 mmHg with normal minute ventilation, and
   - Core temperature < 38.5°C
3. Maximum dose: 10 mg/kg – may be exceeded if treatment goals not achieved

*Dosage is based on **actual body weight**

3. Commence active body cooling

3.1. Give IV 2000 – 3000 mL (adult) or 20 – 40 mL/kg (paediatric) of chilled (4°C) 0.9% saline.
3.2. Surface cooling: wet, cold sheets, fans, and ice packs placed in the axillae and groin.
3.3. Other cooling techniques may be applied at the clinician's discretion.
3.4. Lavage open body cavities with cold saline.
3.5. Stop cooling if temperature is < 38°C, to prevent drift of body temperature < 36°C.

4. Added monitoring

4.1. Core temperature
4.2. Invasive blood pressure – to detect rapid hemodynamic swing and frequent blood taking

4.3. Urine output

5. Blood investigations
    5.1. ABG analysis – most useful investigation
    5.2. Renal profile
    5.3. Coagulation profile
    5.4. Full blood count – hematocrit & platelet level
    5.5. CK level
    5.6. Myoglobin
    5.7. Glucose level

6. Management of the consequences of MH
    6.1. Acidosis
        - Hyperventilation to normocapnia.
        - Consider IV sodium bicarbonate 0.5-1.0 mmol/kg as necessary to maintain pH > 7.2.
    6.2. Hyperkalaemia
        - IV sodium bicarbonate 1-2 mmol/kg
        - IV glucose 50% 50 mL + insulin 10 units (adults). In paediatric patients, IV glucose 25% 2 ml/kg + insulin 0.1 unit/kg
        - IV calcium 0.1 mmol/kg **should only be used as last resort** (influx of extracellular calcium contributes to calcium overload in myoplasm).
        - Renal replacement therapy
    6.3. Arrhythmias
        - Most common arrhythmias in MH is tachyarrhythmias.
        - Usually responds to treatment of acidosis and hyperkalemia. If resistant arrhythmias, consider hyperkalaemia as a cause.
        - IV amiodarone 2-3 mg/kg over 15 minutes.
        - β-blockers (e.g. propranolol/metoprolol/esmolol) if tachycardia persists.
        - Avoid calcium channel blockers which may cause hyperkalemia or cardiac arrest in the presence of dantrolene.
    6.4. Myoglobinuria
        - Aim for urine output > 2 ml/kg/hr
        - Consider forced alkaline diuresis with mannitol/frusemide + IV $NaHCO_3$
        - IV Frusemide 0.5–1.0 mg/kg
        - IV Mannitol 1 g/kg
        - Fluids: IV crystalloids (e.g. lactated Ringer's solution or 0.9% saline)
        - May require renal replacement therapy later
        - Repeat CK every 6-8 hours

6.5. Disseminated Intravascular Coagulation (DIC)
- Consider fresh frozen plasma (FFP), cryoprecipitate, platelets.
- Tranexamic acid is **not indicated**.

6.6. Compartment syndrome
- High clinical suspicion in patients with myoglobinuria
  - Complain of pain in awake patient.
  - Regular assessment of limbs for swelling, muscle softness and peripheral pulses/ SpO_2.
- Treatment: Fasciotomy

7. Post-MH management
   7.1. After the patient is stabilized, all patients with known or suspected MH reactions should be admitted to ICU. Monitor the patient for a minimum of 24 hours as recurrence may occur in up to 25% of patients during the first 24 hours.
   7.2. In the case of recurrence of MH,
   - If within 6 hours of initial reaction – 1 mg/kg IV boluses every 5 minutes.
   - If more than 6 hours of initial reaction – 2.5 mg/kg IV bolus, followed by 1 mg/kg every 5 minutes.
   - Administration of **prophylactic** dantrolene after control of the initial reaction is **not recommended**.

   7.3. Monitor and treat consequences of MH accordingly.

FOLLOW-UP

1. Patient and family counselling
   1.1. Patient and family should be informed about the diagnosis and written information about MH should be provided.
   1.2. Specific advice to warn all blood-related family about the risk of MH and the need to alert the attending medical personnel in case of hospitalization.
2. Reporting and screening/definitive diagnostic test
   2.1. All case of suspected MH has to be referred to MH unit, HKL.
   2.2. Fill up MH notification form as per Appendix B & attach a copy of GA form as well as the investigation chart.
   2.3. Screening or diagnostic testing for MH is not available in Malaysia. However, patient has the option of genetic testing in which the samples will be sent to overseas (through MH unit/genetic clinic in HKL).
3. MH card
   3.1. All patients diagnosed with increased risk of MH should be given an allergy card that should be kept with the patient all the time.

ANAESTHESIA FOR PATIENT WITH INCREASED RISK OF MH

1. Identification of high-risk patients.
    1.1. Patients with high-risk status confirmed by genetic or diagnostic testing
    1.2. Blood relatives of an individual with a confirmed MH
    1.3. Patients with personal or family anaesthetic history which may implicate MH
    1.4. Patients with clinical myopathy who have a genetic aetiology involving a gene implicated in MH susceptibility (*RYR1, CACNA1S, STAC3*)
    1.5. Patients with genetic variant of unknown significances in gene implicated in MH susceptibility
    1.6. Patients with unexplained rhabdomyolysis, especially with history of recurrence
    1.7. Patients with idiopathic raised in serum CK level
    1.8. Patients with unexplained exertional heat illness

2. Regional anaesthesia whenever possible.

3. If general anaesthesia is required
    3.1. GA machine
        - Use a MH-specific GA machine (never exposed to volatile agents), or
        - Flush GA machine (new breathing circuit, new CO_2 absorber, without vaporizer) with 10-15 L/min of 100% oxygen for a time period recommended by manufacturer (target < 5 ppm of inhalation agent) as follow:

Company	Model	Preparation time at max FGF (min)	Ventilator setting
GE Healthcare	Aestiva	Sevoflurane (35) Desflurane (40)	VT 700 mL RR 12 bpm I:E 1:2 PEEP 0 cmH_2O
GE Healthcare	Aisys	Sevoflurane (30) Desflurane (35)	
Drager	Perseus	Sevoflurane (60) Desflurane (60)	IP 50 RR 60 bpm Ti 0.5s PEEP 3 cmH_2O

        - Use activated charcoal filters on inspiratory and expiratory limbs of circuit (if available).
    3.2. TIVA
    3.3. Non-depolarizing muscle relaxant if paralysis is required

4. Minimum monitoring for general anaesthesia, which includes
    4.1. ECG, SpO_2, NIBP
    4.2. FiO_2, $ETCO_2$
    4.3. Airway pressure, minute ventilation
    4.4. Peripheral nerve stimulator if neuromuscular blocking agent is used
    4.5. Continuous core body temperature
    4.6. Depth of anaesthesia

5. Standard care in recovery room after surgery is acceptable if trigger-free anaesthesia is provided and no evidence of intraoperative MH.

Appendix A

Content of MH Cart (recommended by MOH, Malaysia)

	Items	Quantity
1	Dantrolene	12 vials*
2	Sterile water for injection	3 litre
3	50mL syringes and 14G needles	12 units
4	Lignocaine	5 units
5	Amiodarone	5 ampoules
6	Dextrose 50%	4 units
7	Mannitol 25%	1 pint
8	Frusemide	200 mg
9	Sodium bicarbonate 8.4%	10 ampoules
10	Calcium gluconate 10%	4 ampoules
11	Adrenaline 1mg	4 ampoules
12	Normal saline (refrigerated)	6 litre[#]

Others:

- Crushed ice, irrigating Foley catheter, rectal tube, cooling blanket
- Central venous access kits
- New fresh gas circuit, CO2 absorber canisters, breathing circuit, ventilator bellows
- Blood collection tubes, laboratory forms and labels

* Only 6 vials of Dantrolene is available in MH trolley; to get from pharmacy if more is needed.

[#] Available in refrigerator at recovery bay.

Appendix B

PRIVATE AND CONFIDENTIAL **Report for suspected Malignant Hyperthemia Reaction**			
Hospital :			
Patient Contact Details (or Sticker)			
Patient Name :			
IC :			
Address :			
Phone :		Mobile :	
Date of Birth :		sex :	
Name and Contact details of Doctor Completing This Form :			
Name :			
Address (Hosp) :			
Phone :	Mobile :	Email :	
Events			
Date of Procedure :			
Name of Procedure :			
Name of Anaesthetist :			
Drugs administered and doses **(attach a copy of the anaesthetic chart) :**			
Description of events and suspected drug (s) :			
Patient's usual medications :			
Family history of muscle disorders, anaethetics reactions or sudden unexplained death ?			
Number of previous uneventful anaesthetic procedures :			
Untoward events during previous anaesthetic procedures ?			
Reaction (s) :			
Muscle Rigidity			
Generalized Rigidity		Masseter Rigidity shortly following Succinyl choline administration	

Myonecrosis				
Elevated Creatinine Kinase > 10,000 IU (no sux)			Myoglobin in Urine (> 60mcg/L)	
Elevated Creatinine Kinase > 20,000 IU (with sux)		Blood /plasma/serum K^+ >6 mEq/L in the absence of renal failure		
Cola Coloured Urine		Myoglobin in serum > 170 mcg/L		
Respiratory Acidosis				
ET CO_2 > 55 mmHg with appropriately controlled ventilation		Inappropriate hypercarbia		
ET CO_2 > 60 mmHg with spontaneous ventilation		Inappropriate tachypnoea		
$PaCO_2$ > 60 mmHg with controlled ventilation		$PaCO_2$ > 65 mmHg with spontaneous ventilation		
Temperature Increase				
Rapid increase in temperature		Inappropriate temperature > 38.8°C in the perioperative period		
Cardiac Involvement				
Inappropriate tachycardia		VT or VF		
Other				
Rapid reversal of MH signs with Dantrolene		Base excess >- 8meq/L or pH < 7.25		
Positive MH family history together with another indicator from the patients own anaesthetic experience other than elevated resting serum creatine kinase				
Resting elevated serum creatine kinase (in patient with a family history of MH)				
Family History (Used to determine MH susceptibility only)				
Positive MH family history in relative of first degree				
Positive MH family history in relative not of first degree				
*** Please send the completed form to Anaesthetic Department, Hospital Kuala Lumpur.**				

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Job Description for Clinicians in General ICU

Associate Professor Dr Aliza Mohamad Yusof, Associate Professor Dr Raha Abdul Rahman, Associate Professor Dr Azarinah Izaham, Associate Professor Dato' Dr Wan Rahiza Wan Mat, Dr Cheah Saw Kian, Dr Low Hsueh Jing, Dr Mohd Khazrul Nizar Abd Kader

GENERAL INFORMATION

1. Clinicians include doctor practitioners from the Department of Anaesthesiology And Intensive Care.

2. Patient care is under responsibility of multidisciplinary practitioners.

3. Residents are trainees of Doctor in Anaesthesia and Critical Care, UKM postgraduate program. Registrars are residents that are in their third or final year of training. As part of the residents' training, they are to undertake elective rotations in Intensive Care Medicine in the HCTM GICU under the close supervision of intensivists and anaesthesiologist/specialists.

4. In general, the residents are to:
    - 4.1. Always demonstrate professional attitudes and behaviours, including no personal communications via mobile phones during handover rounds.
    - 4.2. Demonstrate a collaborative approach to the care of critically ill patients that respects the expertise of all caregivers including ICU nurses, pharmacists, physiotherapists, and the multidisciplinary clinical teams.
    - 4.3. Be immediately to attend to the ICU patients (be it in the unit or at the wards) and address ICU consults.

5. The working hours in ICU are:
    - 5.1. On-calls are 24 hours shifts between 0800H of the on-call day till the next day after 0800H.
    - 5.2. Daytime coverage shifts are between 0800H to 1600H & 1500H to 2100H.

6. Handover rounds are to be done when your shifts end which are the mornings after the on-call or when the daytime coverage duties complete. Clinical patient care responsibilities shall finish once handover rounds completed.

RESPONSIBILITIES OF HEAD OF UNIT

1. Arrange, monitor, and implement management and workflows in the unit.
    1.1. Ensure that the care of critical patients by consultants, specialists, residents and nurses is safe, efficient, effective; and follows guidelines, policies and standard clinical protocols.
    1.2. Regularly monitor and review policies and procedures for activities involving critical care patients.
    1.3. Planning procedures and plans for the increase of beds and staff required to treat patients & bed mobilization when needed.

2. Ensuring that the facilities and equipment required to care for critical patients are appropriate and sufficient.
    2.1. Manage and monitor the budget for purchasing assets and equipment which is affordable and accurately planned.
    2.2. Screen assets required to avoid wasteful asset purchases.

3. Career development and staff training calendar management
    3.1. Hold a discussion with unit team members on the training required to improve the performance of critical service personnel.
    3.2. Planning and monitoring the training plan for personnel of the unit.
    3.3. Organizing activities and training courses at the unit level.

4. Carry out quality assurance activities and monitor the performance of the unit.
    4.1. Monitor units' performance such as patient mortality rates.
    4.2. Running an 'internal audit' program involving the unit.

5. Disaster coordination and coordination during a pandemic.
    5.1. Planning procedures and plans for beds and staff required to treat patients.

6. Research collaboration between other critical care units.
    6.1. Conduct discussions between head of units if there is research involving other critical care units.
    6.2. Monitor research involving patients in the unit.

RESPONSIBILITIES OF INTENSIVE CARE CONSULTANT (CONSULTANT INTENSIVIST / CONSULTANT ANAESTHESIOLOGIST)

1. Responsible for the overall dynamics of ICU team.
2. Responsible for the consultation, formulation of patient management and review in GICU.
3. Consultation and formulation of patient management for Periphery ICU whenever appropriate.
4. Receiving and discussion on new referral cases during and after office hour whenever appropriate.
5. Division of manpower on the day of in-charge.
6. Decision of admission and bed mobilisation for GICU.
7. Troubleshooting of any issues in difficult cases, in relation to patient management and family communication.
8. Decision on implementation of end-of-life care.

RESPONSIBILITIES OF GICU SPECIALISTS

1. Assist in management of the planning, coordination and implementation of clinical operations to ensure that patients receive safe and qualified treatment within a reasonable period in a fair and affordable manner.
    1.1. Supervise and carry out care for patients registered in the unit and ensure patient's care in compliance with the established Clinical Practice Guidelines/policy/standard.
    1.2. Carrying out life-saving emergency care when necessary, in the premises or area of responsibility.
    1.3. Hold discussions related to patient management.
    1.4. Monitor and ensure that medication and equipment are adequately functioning.
    1.5. Help supervise and guide the staffs in the unit.
    1.6. Be a reference point for other departments/hospitals/external agencies and students in matters related to expertise or unit/discipline services.

2. Assist in monitoring the implementation of the professional responsibilities of staff under supervision as registered medical practitioners on duty in the clinical organization to ensure the delivery of services following the set professional standards.
    2.1. Monitor and provide advisory services related to managing medicolegal cases.
    2.2. Arrange appropriate training programs to improve professional skills and knowledge to meet the Annual Practice Certificate (APC) renewal

requirements.

2.3. Conduct continuous teaching sessions such as CME or short-term courses.
2.4. Review reports related to patient care.
2.5. Develop and monitor the implementation of systems, programs and specific procedures to ensure patient safety.
2.6. Monitor the reporting of cases that need to be notified, incidents or medical/transfusions according to the existing SOP.

3. Assist in the planning, management and implementation of clinical administration, workforce management and asset/procurement management according to the regulations, procedures, directions and objectives determined within the specified period.
   3.1. Formulate and enact policies related to patient safety and risk management.
   3.2. Coordinate activities related to clinical governance programs.
   3.3. Member of a committee or discussion related to policy/SOP, including M&M.
   3.4. Prepare reports or discussion papers for meetings related to patient treatment.
   3.5. Planning resource requirements regarding talent, biomedical equipment and information technology.
   3.6. Ensure the need for equipment, facilities and infrastructure that support patient care is sufficient, and workplace safety is guaranteed.
   3.7. Coordinate implementing quality management programs that align with Public Institution of Higher Education's strategic direction.
   3.8. Prepare reports or discussion papers for meetings related to patient treatment.

4. Assist in planning and supervise activities related to the knowledge ecosystem to fulfil HCTM's aspirations as a teaching hospital under UKM.
   4.1. Coordinating and conducting continuous teaching sessions such as CME or short-term courses.
   4.2. Provide advice, guide and supervise staff or students in research activities.
   4.3. Get involved by forming a network of local or international expertise.
   4.4. Prepare a proposal paper for activities or programs related to the community.
   4.5. Coordinate knowledge-sharing activities at the department or university level through academic writing, research and lectures.
   4.6. Carry out supervision and teaching related to the university's academic programs, such as training and examinations for the level of Master's Program, Graduate Medical Officer, Bachelor of Medicine Degree Program, and Allied Health Program, which is placed periodically.

RESPONSIBILITIES OF GICU REGISTRARS

1. The registrars of ICU (RICU) are team leaders of the ICU on-call teams. Under the supervision of specialists/intensivists, they are responsible for:
    1.1. The overall dynamics of the ICU resident team.
        - Delegate the ICU referrals to be seen by the ICU residents when RICUs are unable to attend to the ICU referrals.
        - Referrals that were delegated to the ICU residents to review **must** be discussed with the RICUs before consulting the attending specialist/intensivist.
        - **All** referrals **must** be discussed with the attending specialist/intensivist.
    1.2. The managements and progress of ICU patients.
        - ICU patients are patients within the unit and out of the unit in the wards or emergency department.
        - RICU must know the important issues pertaining to the patients in the unit. The night rounds for in-house ICU patients must be performed along with the residents and ensured that the plans of care during daytime are implemented. The night progress of in-house ICU patients **must** be updated to the on-call specialist especially ill patients.
        - RICUs to respond to the new issues that arise overnight under the care of ICU team and the plan **must** be discussed with on-call specialist after office hours.
        - RICUs continue the review of ICU patients outside the unit overnight.
        - Prepare and present in detail, on morning rounds the next day of the change of plan of care, all new referral cases and patient's that pending ICU admission that occurred during the on-call shift.
        - **All** M&M should be notified to the specialist in charge and specialist oncall.

2. The management of ICU beds. The RICU is responsible to:
    2.1. Keep track on the number of ICU beds available for admissions and the number of ICU beds being booked.
    2.2. Identify patients in the unit that can be discharged.
    2.3. Decide whether new referrals or ICU patients outside the unit require ICU admissions.
    2.4. Decide the appropriateness of patient's mobilization in the unit for emergency and elective admissions.
    2.5. Pre-emptively arrange an urgent discharge with the primary team to accommodate elective cases (if possible) prior to morning rounds or

emergency cases at ad hoc after discussion with the on-call specialist.

3. The ICU referrals.
   All referrals **must** be discussed with specialists in charge.
   3.1. The usual reasons for the referrals are for:
   - ICU admission.
   - Initiation of NIV therapy. If the NIV therapies are initiated, to complete the NIV forms.
   - Transport of critically ill patients to OT or radiology department from other critical care areas and wards when they are mechanically ventilated.
   - Sedation of critically ill patients for procedures outside ICU.
   - Patients requiring resuscitation outside the unit (**CODEBLUE**). During resuscitation, RICU **must** take the role of team leader. Document the referrals in the ICU referral forms.
   - **All** outsource to other hospital, referral will be made by primary team.
   - **No direct referrals to ICU team from other hospitals.**
   - **All** AOR discharge by families to be notified to primary team and specialists in charge.

   3.2. Document thoroughly, including the full histories, physical examinations, impression/working diagnosis and plans of care in the case notes, and assess whether transfer to ICU will benefit patient's care. Any communication with the primary teams must be included.
   3.3. Perform necessary technical procedures on ICU patients in the unit or out of the unit as appropriate to the registrar's knowledge such as bronchoscopy, depending upon the urgency and stability of the procedure. The procedures performed should be documented in patients' case notes.

4. Completion of these following forms is compulsory:
   4.1. ICU referral form: following reviewing of any referral.
   4.2. NIV referral and progress form: following initiation of NIV therapy outside the unit.
   4.3. **CODE BLUE** form: when attending anyone with cardio respiratory arrest that occurred in Zone B (staffs or the public).
   4.4. Elective booking form: planned admission postoperatively.

5. Covering daytime duties, the RICU must:
   5.1. Review ICU patients that are inside the unit (daytime RICU tag).
   5.2. Review ICU patients that are outside the unit (peripheral ICU patients).
   5.3. Respond to any new referral and resuscitation during their shifts.
   5.4. Reassess and formulate the plans for peripheral ICU patients.

5.5. Screen and decide whether any of the peripheral ICU patients may benefit from transferring into the unit.
5.6. **Must** discuss pre-emptively with the attending specialist/intensivist regarding the formulation, change of patient's treatment plan, and selection of potential ICU admission.
5.7. Handover patient's progress to RICU and the attending specialist/intensivist before ending the working shift.

RESPONSIBILITIES OF GICU RESIDENTS

1. The ICU residents are key clinicians responsible for providing critical care to variable numbers of patients in the unit. The residents **must** familiarize in-depth the patients' medical histories and diagnosis, hospital courses and ongoing/new issues and able to present fluently at handover rounds to the attending specialist/intensivist by utilizing a systems-based approach. Therefore, they are expected to:
    1.1. Perform systematic assessments of new admission with the assistance of the RICU and supervised by specialist/intensivist.
    1.2. Perform regular clinical assessments including a thorough physical examination and reviewing relevant investigations of their assigned patients to enable plans of care to be formulated.
    1.3. Ensure that the plans of care are implemented and to monitor patients' progress that may require change or modification of these plans.
    1.4. Prescribe appropriate and relevant medications pertaining to the care of the patients. Antimicrobial prescriptions are to be discussed with attending specialist/intensivist. Appropriateness for anticoagulants as deep vein thrombosis prophylaxes and patient's mobilization are assessed daily.
    1.5. Perform necessary technical procedures as appropriate to the residents' knowledge and ability, and depending upon urgency and stability of the procedure. Supervision should be sought if residents are inapt in performing any procedures.
    1.6. Follow-up necessary laboratory and imaging test results that were previously sent prior to admission and recently ordered in ICU.
    1.7. Immediately notify the RICU or attending specialist/intensivist the progress of patients especially when new issues arise or any acute changes in patients' condition.

2. In the event when the registrars are unable to attend to ICU referrals, ICU residents are delegated to review and discuss the referrals with the registrar. It is also the responsibility of the residents to document clearly:
    2.1. In detail within patients' case notes the summary of active issues, physical

assessments and plan, including the procedures performed.

2.2. In the appropriate charts, the blood investigation and culture results. These charts are to be updated regularly and when results become available.

2.3. The APACHE II form upon admission and facilitate the discharge of suitable patients from the ICU by writing discharge summary, appropriate transfer orders and review of drug prescriptions.

2.4. The daily SOFA score of patients under designated care.

3. Any documentation **must** be followed with residents' official stamps. Any documentation without official stamp, the case notes will be returned to the residents to apply the stamp by the record office.

4. Residents are to liaise well with:

4.1. The multidisciplinary medical teams in treating the patients.

4.2. The nursing and allied health staffs in implementing treatment plans.

4.3. Patients and their family members in gathering information and in providing bedside updates and formal family meetings.

4.4. The respective supervisors regarding the ICU end-of-rotation evaluation.

RESPONSIBILITY OF HOUSE OFFICER

1. Detailed clerking and examination of new cases with MOs during GICU admission.
2. Familiarize with patient diagnoses, hospital course and ongoing/new issues.
3. Follow-up necessary laboratory and imaging test results. Document blood investigation results including cultures in the appropriate investigation flow chart and culture form respectively.

Operational Policy for General ICU

Associate Professor Dr Aliza Mohamad Yusof, Associate Professor Dato' Dr Wan Rahiza Wan Mat, Associate Professor Dr Raha Abdul Rahman, Dr Cheah Saw Kian, Dr Low Hsueh Jing, Dr Mohd Khazrul Nizar Abd Kader

This document is to facilitate effective management and understanding of the critical care unit and should be used to understand the critical ill patient's pathway. The operational policies for the COVID ICU and other critical areas should be used in conjunction with this policy where applicable.

INTRODUCTION

The main objective of intensive care service is to provide the highest possible standard of care using evidence-based practice in all critically ill patients who require intensive monitoring or advanced life support in a safe and comfortable environment for patients and their relatives. This policy document covers key areas of intensive care services such as organisation, human resource, asset requirements as well as patient management, ethics, and clinical governance.

This policy is intended to guide health care providers on development and implementation of intensive care services in HCTM. The documents outline optimal achievable standards in accordance with best practices and guidelines. The document shall be reviewed and updated every 5 years or when need arises.

MISSIONS & VISIONS

1. To provide critical care medicine management, intervention and organ support for the critically ill patients with a reversible medical condition that have a reasonable prospect of meaningful recovery in concordance with respect towards patient's autonomy, non-maleficence, beneficence and justice values.
2. To establish the ICU as one of the centres of excellence in clinical practices, academics and research pertaining to the field of Intensive Care Medicine.

OBJECTIVES & GOALS

1. To provide the highest standard of care by implementing evidence-based practice in all critically ill patients.
2. To offer a comprehensive and holistic critical care services lead by a dedicated intensive care team with collaboration with trained nurses, pharmacists and other allied health including physiotherapist, nutritionist, radiographer and assistant science officer.
3. To deliver intensive monitoring and advanced life support whenever feasible and appropriate.
4. To create a safe care and environment for the critically ill patients by providing adequate medication, related equipment and trained manpower.
5. To maintain the quality of standard of practices in Intensive Care Medicine by delivering the academic knowledge and its application via activities including but not limited to teaching, lectures, communications, publications, professional practices and internal audit.
6. To demonstrate empathy and understanding when dealing with end-of-life care issues which include withholding, withdrawal and limitation of organ support without imposing further suffering on patients and their relatives.
7. To demonstrate professionalism in achieving effective communication during daily hand-over or case discussion among colleagues which include within ICU team, multidisciplinary team, nurses, pharmacists and allied health.
8. To demonstrate an effective, professional and transparent communication with the patient and their families or surrogates.
9. To respect a patient's right to privacy, dignity and confidentiality which include consultation, discussion, communication and medical records.
10. To conduct and collaborate research pertaining to Intensive Care Medicine following medical and research ethics with the aim of generation in grant and publication in high impact journals.

SCOPE OF SERVICES

1. Care for the critically ill patients, requiring intensive monitoring and intervention or advanced life support (Appendix A).
2. Resuscitation services and respond toward code blue in Zone B, HCTM.

HUMAN RESOURCES

1. The HOD of Anaesthesiology and Intensive Care oversees the administrative, clinical, research and academic component for the smooth operation of the Anaesthesia, Intensive Care and Pain services.
2. The Head of ICU is responsible to oversee the specific administrative, clinical, research as well as academic part for the smooth operation of Intensive Care services.
3. The Intensive Care Consultant is responsible for the consultation and formulation of patient's management, development of protocols, tutorial, continuous medical education, quality assurance and research.
4. The Specialist is responsible for patient's management, training of MOs related to academic knowledge or procedure in Intensive Care Medicine, preparation of audit and research supervision.
5. The MOs are either the Service MO or MOs In-training for the postgraduate program. They are responsible for carrying out the patient's management and policies to their best ability which is performed under supervision by the Specialist or Intensive Care Consultant.
6. The Assistant Medical Science Officer is responsible for preparing the equipment budget, documentation on periodic maintenance services, safety testing, certification, inventory, complaint record follows up and user training. They are also responsible for preparation of equipment for related procedures.
7. The Chief Executive of Nursing is responsible for coordination, monitoring and planning of critical care nursing administrative, clinical, and training procedures as well as responsible for the nursing staff and attendants working in ICU.
8. The Head Nurse is responsible for overall patient's nursing care, staff roster, leave and in-charge of overall ICU including medication and daily equipment inventory.
9. The Staff Nurse is involved in the nursing care of Intensive Care patients, documentation of clinical progress, assists in procedures and is partly involved in the patient's rehabilitation program.
10. Multi-disciplinary team consists of a primary team that either directly or indirectly provides care for the patient admitted in the ICU, and supportive teams, or any other relevant physicians and/or surgical related teams.
11. Various Allied Health staff provide supportive care towards patients' care.

GENERAL OPERATION POLICIES

1. The Intensive Care team consists of ICU consultant and/or specialist, anaesthesia registrar, anaesthesia MO, attachment MOs from various other postgraduate clinical program for example Emergency, Surgery and Maxillofacial Department, as well as anaesthetic house-officer.

2. The ICU review consists of handover and follow-up rounds.
    2.1. The handover round by Intensive Care team consists of handing over the care of peripheral patients, the in-patient and patient that is planned for perioperative admission by the post call to the on-call team.
    2.2. The discussion of peripheral patient's care and further plan by the ICU consultant and/or specialist shall be documented in the patient's case note.
    2.3. The review of in-patient with ICU consultant or specialist is done during morning handover round. The respective MO that is in-charge of the patient are expected to have a thorough review according to system and review the input from other medical as well as allied health teams before the morning rounds.
    2.4. The follow-up round involves peripheral patients as well as the in-patient. It is to follow-up the patient's progress and usually takes place in the afternoon either with the ICU consultant, specialist on-call or registrar. The hand-over of cases to specialist on-call is also held during this time.

3. The anaesthetic team in charge of the planned surgery that requires postoperative intensive care should make the ICU booking ahead of the surgery date. For elective cases, booking must be made latest by the day before surgery.

4. The primary team should alert the Intensive Care team via a formal request to the HOD of Department of Anaesthesiology & Intensive Care for complex major surgery that requires postoperative intensive care preferably 2 weeks prior to the surgery. This booking will be recorded in the Booking Book.

5. The confirmation of bed availability is dependent on daily ICU bed status. The decision to release ICU beds for perioperative booking admission shall be performed by the ICU consultant and/or specialist.

6. All referral to the Intensive Care team should be discussed with either the ICU consultant or specialist on duty. The discussion of cases during office hours is preferably directed to the ICU consultant on-call.

7. The discussion of cases after office hours is preferably directed to the specialist on-call unless there are other needs that require ICU consultant opinion.

ADMISSION AND DISCHARGE

1. The patient admitted into the ICU shall be treated by the doctors from The Department of Anaesthesiology and Intensive Care in a professional and caring manner. The unit consists of admission for multidisciplinary cases of critically ill patients.

2. The primary or referring unit shall discuss their referrals with the Intensive Care team and this includes prior to acceptance of any patient from another hospital if ICU admission is anticipated. The admission to ICU will require a negative COVID-19 test PCR during the COVID-19 pandemic. The type of PCR test accepted for ICU admission, either rapid or real-time will depend on anaesthesia department consensus.

3. All patients admitted in ICU shall have a primary admitting unit and this includes referral from other hospitals. Any transfer of primary care shall be documented and discussed among respective relevant teams. The primary or referring team shall continue to provide care for the patient until the patient is admitted in the ICU if agreed for admission. The consultations with other relevant units shall be performed by the Intensive Care Team if need arises. The number of primary/visiting doctors shall be limited to 3 people per team. HOs of the treating units shall not review the patients in ICU without an attending MO / specialist.

4. The ICU consultant or specialist shall decide which patient is suitable for ICU discharge. In urgent cases, the RICU in-charge is also able to decide for patient discharge only after discussion with their specialists/consultants. All discharges to the ward shall inform the primary unit prior to transfer. A complete discharge summary consists of diagnosis, progress, management in the unit and further management plan shall be attached to the patient's case note prior to transfer. The patient's family is also to be informed of the discharge.

5. The request of discharges of ill patients by family to home shall be considered as AOR discharge and discussed with the primary team. Prior approval by the Hospital Director is requested by the primary team. Arrangement of transfer of patient shall be made by the patient's family.

6. Further information on ICU admission and discharge; please refer to Guidelines of Admission and Discharges for GICU, HCTM.

GUIDELINES AND MANAGEMENT

1. All hospital and unit local policies will be held in the unit's policy folder.

2. Drugs prescribed to patients shall be in accordance with the MOH & HCTM approved list of drugs. Strict measures shall be taken to prevent medication errors in the unit. All medication ordered shall be written in the prescription chart by doctors from the intensive care team. Orders by doctors from other units shall be discussed and agreed upon by the intensive care team prior to initiation.

3. The unit shall comply with all hospital infection control policies. Infection control measures in the ICU shall be guided by the HCTM infection Control guideline.

4. CVC Care Bundle and measures to prevent catheter-related blood stream infection shall be applied to all patients with CVC. Please refer to Guideline for Central Venous Access, HCTM, 2019.

5. Ventilator Care Bundle and measures to prevent ventilator-associated pneumonia shall be applied to all patients who are mechanically ventilated. Please refer to Guideline for Ventilator Associated pneumonia Bundle, HCTM 2023.

6. Management of patients with severe sepsis or septic shock shall be in accordance with Surviving Sepsis Campaign Guidelines. Please refer to Surviving Sepsis Campaign; International Guidelines for the Management of Severe Sepsis and Septic Shock,2016.

7. All ICU patients shall receive early mobilization therapy. Please refer to Management Protocols in ICU 2019 for Early Mobilization of patients in ICU.

8. The prescribing of antimicrobials shall be guided by the related guidelines. Please refer to the HCTM ICU antibiotic protocol.

9. Patients shall be screened for their nutritional status and fed according to the Protocol on Enteral and Parenteral Nutrition in ICU. Please refer to HCTM Nutrition protocol for ICU.

10. Transport of patients from and to ICU should follow local guidelines. Please refer to HCTM guidelines for transport of critically ill patients.

11. When continuing intensive care is deemed medically futile; consideration shall be given to limitation or withholding of life-support. This decision shall be discussed with the primary team, patient's family and other team members as appropriate. Please

refer to Withholding and Withdrawing of Life Support Therapy in ICU, Management Protocols in ICU, 2019.

12. For cardiac arrest, the recommended policy is that following the American Heart Association guidelines for CPR with some modification to suit the local situation. Specialist, MO and staff nurses should familiarize with the location of the resuscitation trolley. Drugs and equipment inside the resuscitation trolley must be kept up to date.

13. The decision to withhold CPR will be decided after discussion with the consultant/specialist in ICU or on-call with the view of family members and/or other health care professionals involved in the treatment of the patient taken into consideration.

14. Patients diagnosed with brain death will not be admitted into ICU, unless identified for organ harvesting and transplantation. All patients suspected to have brain death would go through the process of Brain Death Certification using Brain Death Guidelines, MOH and Academy of Medicine Malaysia 2006.

PATIENT'S CARE IMPROVEMENT ACTIVITIES

1. Multidisciplinary discussion involving ICU team, Infectious disease (ID) team, microbiologist, and pharmacist to provide appropriate antimicrobial therapy along with antimicrobial stewardship program.

2. Nutrition of the patients are ensured by a multidisciplinary team consisting of dieticians and/or Total Parenteral Nutrition pharmacist.

3. Regular physiotherapy session in ICU with a trained therapist to prevent muscle wasting and joint immobility.

4. All medical and nursing staff of the ICU should have at least completed and passes their BLS with emphasis to complete and pass their ACLS training (or its equivalent), accredited by a local or international BLS/ACLS Provider Training Program.

ANTIMICROBIAL STEWARDSHIP

1. The appropriate and rational use of antibiotic will minimise the emergence of Resistant strains and increase the cost-effectiveness of therapy, therefore stressing the need for guidelines in their use.

2. Adherence to the principles and guidelines of antimicrobial use is extremely important. Restraint in the use of new and often powerful antimicrobials is the best way to ensure their continuing efficacy.

3. Establish the need for antibiotics, as some disease may be viral in origin or is a self-limiting bacterial disease.

4. All microbiological specimens (blood, urine, aspirate, etc.) must be taken under strict aseptic conditions for cultures and sensitivity, as well as Gram staining prior to starting antibiotic therapy.

5. Drugs with narrow therapeutic windows must be monitored frequently especially those patients who are having renal dysfunction. Monitoring the serum concentrations of antibiotics stating peak and trough levels are important to ensure proper dose and dosing interval.

6. Types of therapy:

Prophylactic	Restricted to situations that have proven effectiveness of such therapy or where the consequence of infection is disastrous.
Empirical	This is based on local epidemiological data on potential pathogens and the patterns of antimicrobial susceptibility as indicated by an antibiogram chart (Appendix B).
Directed	These are based on culture and sensitivity results. Antibiotics used should also be the most effective, least toxic, narrowest spectrum agent.

INFECTION CONTROL

1. All visitors and health professionals will be expected to wash their hands or decontaminate them with gel upon entering the Unit, or a bed space and in accordance with the WHO 5 moments of hand hygiene. In addition, staff must wear a disposable apron when in a bedspace or in contact with blood and body fluids. Additional precautions may be required with some patients. All staff and visitors must take appropriate precautions to avoid cross contamination.

2. Patients with infections which are transmissible via direct contact (e.g. Methicillin-resistant Staphylococcus aureus, Extended-spectrum beta-lactamases, etc.).
    2.1. The ICU policy and procedure require these patients to be nursed using contact precautions. This will be achieved using isolation in single rooms if available. Where this is not possible patients will be risk assessed and barrier nursing precautions at the patient's bedside will be used. Advice will be sought from the HCTM's Infection Control team.

3. Patients with infections which are transmissible via the faecal/oral route (e.g. patients with diarrhoea identified as clostridium difficile, norovirus etc.)
    3.1. These patients will need to be nursed using enteric precautions ideally in a single room. Discussion and/or risk assessment must take place with the Infection Control team as to the best option for both the patient and clinical areas. Cohorting patients with proven non-infective diarrhoea is an option if single rooms are not available.

4. All patients admitted to ICU will be screened using nasal and rectal swab where appropriate until advised otherwise by the Infection Control team.

WASTE MANAGEMENT

1. Clinical waste
    1.1. All clinical waste must be segregated at source and be placed in appropriate coloured coded bag, sealed, and placed in the designated waste area for collection. Clinical waste will be removed by the porters.

2. Sharps disposal
    2.1. All staff must adhere to the hospital policy for the disposal of sharps (Management & prevention of sharps / splash injuries policy and procedure).

3. Non-clinical waste
    3.1. Must be segregated at source and be placed in appropriate bags, sealed, and placed in the designated waste area for collection by porter staff.

4. Please refer to the hospital policy and procedure for the management of healthcare waste for further information.

FACILITIES

1. There shall be a clear signage of entry and exit routes.

2. There shall be a well-documented Disaster Plan. Fire extinguisher shall be made available at designated space.

3. The area for each bed shall be sufficient to allow easy access to the patient and to allow the deployment of equipment needed to manage the patient appropriately. It shall also consider the risk of cross infection.

4. Intensive Care Unit shall be provided with isolation rooms for isolation of patients who are highly infectious.

5. All Critical Care patients will require input from chemical pathology as required by their clinical condition. This service is needed out of hours every day of the year. Samples will need to be sent from the unit to the laboratory via the vacuum transfer system or the porter service.

6. The ICU has blood gas analysers for use by staff who have been appropriately trained. The blood gas analyser is maintained by ICU staff with input from biomedical engineering. Other departments may request that samples from outside the unit to be processed on this blood gas analyser, by trained nursing staff in the unit.

7. All Critical Care patients may require radiological investigations. The frequency of this will depend on their medical condition and progress. Portable X-ray will be needed for ICU patients. Usual precautions will be adopted when in use. A suitable PC with access to the Picture Archiving and Communication System (PACS) and suitable monitor for reviewing radiography will be available on each Critical Care unit and staff trained in its use.

8. There shall be adequate infrastructure to support renal replacement therapy for critically ill patients.

9. Supplies of linen are replenished daily. Supplies of disposable curtains are held by domestic services and changed as per policy.

10. Cleaning is performed as per domestic schedule, with a dedicated cleaner from Monday to Sunday. Separate areas for cleaning and storage of equipment are provided.

11. Clinical supplies are replenished by the hospital Materials Management service on a regular basis, and stores located in the designated storerooms provided.

12. Apart from patient care areas there is a designated room/area for counselling of relatives.

13. There are facilities for staff changing, with limited locker space. The hospital does not accept liability for the loss or damage to the personal property of staff.

14. There is a staff restroom where staff can take their breaks and facilities to make tea and coffee and eat their food with access to a microwave and toaster.

EQUIPMENT

1. Equipment in ICU shall be of appropriate type and quantity suitable for the function and workload of the unit. All emergency and life support equipment shall be readily accessible and functional.

2. All equipment shall be in good working condition and there shall be planned preventive maintenance schedules and regular safety tests on all equipment.

3. All ICU patients will require equipment serviced and supported by the biomedical engineering service. This service needs to be available every day of the year. The service will advise on purchasing and commissioning of new equipment and be responsible for service contracts both internally and with external companies. Where possible, servicing of equipment will be undertaken on site.

4. All critical equipment shall be connected to Uninterrupted Power Supply (UPS).

5. Medical gases and suction are needed at every bed space. All outlets to be fully functional, any faults must be reported immediately.

6. Each ICU bed shall have complete vital signs monitoring which are attached to monitors at the central nurse station.

7. The ICU has their own bronchoscope kept in the equipment room. This is prepared and cleaned by an assistant medical science officer.

8. There shall be equipment to facilitate mobilization of patients.

DRESS CODE IN ICU

1. This dress code is applicable to healthcare workers and visitors to ICU.

2. All healthcare workers in ICU should always wear appropriate ICU attire or scrubs. Visitors should wear appropriate and clean attire when visiting ICU patients.

3. No clinical coat should be worn in the ICU.

4. Other consideration including but not limited to:
    4.1. Hijab or cap that is firmly kept in place and should not drop or hang over the patient.
    4.2. Long hair should be firmly tied up.
    4.3. Long sleeves that are folded elbow length.
    4.4. Identification cards that are attached to lanyards should not be dangling over the patient.
    4.5. Neckties that are clipped or kept in place and should not drop or hang over the patient.
    4.6. It is not advisable to wear jewelleries or watches when attending patients.

REGULATIONS FOR VISITOR

1. Visiting times as stated by hospital visiting hours and to take turns 2 visitors per patient at a time.
2. Visitors are not allowed to see patients during medical procedures or during ICU rounds/review or handover.
3. Visitors can be allowed to enter ICU out of visiting hours with the consent of the doctor in-charge of the patient when required.
4. Visiting a patient into the isolation room is at discretion of the doctor in-charge with strict universal precautions.
5. All visitors during the visit should be as quiet as possible. They are not allowed to roam around the ICU or see other patients.
6. Visitors are not allowed to bring flowers or plants, outside foods, and medication. Any personal items are allowed at discretion of the doctor-in-charge.
7. Strict adherence to hand washing and universal protocols of ICU are required.

COPING WITH RELATIVES AND PATIENTS

1. The doctors and nurses caring for the patient should convey the information to relatives regarding the general condition of the patient and management plan, whenever possible. Any misinformation or misconception of a patient's condition must be rectified.
2. The explanation should be simple, clear, concise and in a consistent manner. Questions are encouraged and answered in an appropriate manner. Assurance and empathy must be emphasized to relieve anxiety and suffering experienced by patients and their family members.
3. The language translator should be involved when the need arises.
4. It is highly important that discussion regarding the patient's progress and plan should involve the family member(s) who have been identified as a spokesperson for the family.
5. Updating information via telephone is only to inform the current condition of the patient unless the informed person is the immediate family member or family spokesperson.
6. All interviews with family members should be done in a suitable, dedicated counselling room. All discussions with relatives shall be documented in the patient's case note.

TRAINING AND EDUCATION

1. The ICU must have on-going academic programs. The teaching and training program must cover all levels of ICU staff.
2. As a teaching hospital for UKM, training of undergraduate students should follow Standard for Undergraduate Medical Education, Malaysian Medical Council, 2019. For the programme of Doctor of Anaesthesiology & Critical Care, please refer to Malaysian Standards for Medical Specialist Training, Malaysian Medical Council, 2019.
3. The department shall assess the level of knowledge, skills, and training requirements for all its personnel. The minimum period of training for a MO to work independently in ICU:
    3.1. Postgraduate trainee: depending on academic year.
    3.2. Service MO: 4-12 weeks.
4. However, this shall be assessed on a case-to-case basis and only a MO who is competent shall be allowed to do on-call duties.
5. A written, structured orientation programme shall be used to introduce new staff to the relevant aspects of the facilities and prepare them for their roles and responsibilities.
6. The staff shall have access to appropriate educational programmes to maintain and augment their professional competency. Participation in these educational or training

activities shall be documented in *Sistem Pengurusan Latihan* (UrusBakat UKM) or Malaysian Medical Association – Continuing Professional Development (MMA CPD).

7. The department shall encourage staff to attend relevant educational programmes conducted by professional bodies, societies, and educational institutes.

CONSENT AND ETHICS

1. Caring for the patient and family should take precedence over "all-out" preservation of life per se.
2. The wishes of a competent patient to refuse treatment must be respected, provided it is within the legal law of the country.
3. Patients or family members who wish to embark on alternative treatment modes (traditional, homeopathy, acupuncture etc.) while in ICU will be considered by the ICU and/or primary team.
4. It is appropriate to withdraw or withhold treatment which has failed or has complications that outweigh benefits when prognosis is grave with futility of treatment, and when quality of life is not expected to be acceptable to the patient.
5. All medical teams should reach a consensus of withdrawal of treatment. The medical decision must be explained to the relatives. All discussion must be documented clearly, reviewed, and re-evaluated.
6. Procedure such as invasive arterial monitoring, central lines, double lumen, chest tube insertion and bronchoscopy are considered as a part of standard of care and hence consent from patients or relatives are not required.
7. Other procedures or surgery in ICU require consent from a patient or relative.
8. Intubated patients or patients under sedation who are deemed incapable of giving consent, should have the consent sign by surrogates in priority manner which include spouses, adult offspring, parents, and nearest living relatives.
9. In live saving situation where all efforts to trace relatives and next-of-kin have failed, a consensus of the primary surgeon/physician (who is managing the patient) and a second registered practitioner is obtained and the primary surgeon/physician signs a statement with the consent form stating that the delay is likely to endanger the life of the patient. The second registered medical practitioner must co-sign the consent form. The consent and efforts made to trace the relatives/next-of-kin shall be documented.

PATIENTS RIGHTS AND CONFIDENTIALITY

1. Each patient's right to privacy, dignity and confidentiality is recognized and respected as stated in the provisions of the Health Service Act of the MOH, the HCTM code of ethics and policy, and that of the ICU staff's respective professional code of ethics.
2. Any breach of confidentiality by the ICU staff may be dealt with by disciplinary offence.
3. All ICU staff when working in ICU shall always wear the HCTM identification badges, to safeguard the ICU patient against unidentified and unauthorized persons.
4. Any legal documentation must be signed and stamped officially.
5. Any concern about the propriety of providing information about a patient, the matter should be referred to the Head of ICU or its equivalent or to the Hospital Director.

QUALITY AND RESEARCH

1. The department shall support research activities by providing funding, facilities, and protected time for the staff. The department shall support international multi-centre clinical trials.
2. The department also shall conduct hospital or department specific quality improvement studies. There shall be a mechanism for audit findings to be used effectively for continuous improvement of patient care.
3. To achieve the above objectives, the ICU participate in the following quality initiatives:
    3.1. Incident reporting
    3.2. KPI
    3.3. M&M review.

No	KPI	Target	Reporting frequency
1	Rate of Ventilator Associated Pneumonia (VAP)	< 10 per 1000 ventilator days	Annually
2	Rate of catheter related bloodstream infection	< 5 per 1000 catheter days	Annually
3	Rate of pressure ulcers	< 3%	Annually
4	Accidental extubation	< 5 %	Annually

4. Audit and peer review exercises will document and improve the quality of care. This includes:
    4.1. Documentation to show that the ICU functions according to its operational guidelines and conforms to policies and specialist bodies.
    4.2. Keeping data and records on clinical workload and case admission.
    4.3. Audits of clinical performances conducted as peer review meetings, CPC conferences and critical incident reporting.
    4.4. Quality of care measurements are difficult to measure and perform thus, certain scoring systems acceptable universally and locally are used. APACHE II score is used in this matter.
5. There shall be a continuous process of clinical data collection and analysis to establish the changing pattern in clinical practice as well as M&M.
6. Data shall be collected using a standard procedure or format for the purpose of comparison and analysis.

GENERAL HOSPITAL OPERATIONAL POLICIES

The ICU shall abide in the following areas:

1. Hospital admission and discharge policy.
2. Visitor and visiting hours.
3. End of Life Care, Withholding and Withdrawal.
4. Patients' Rights and Responsibilities.
5. Organ Donation and Procurement.
6. Infection Control Policy.
7. Central Sterilisation Services.
8. Management of hospital waste.
9. Policy on supply of pharmaceuticals and consumables.
10. Policy of procurement of assets and medical equipment.
11. Catering services.
12. Laundry and linen supply.
13. Cleaning Services.
14. Engineering services including maintenance services.
15. Security services.
16. Fire precaution and Disaster Plan for Mass Casualties.
17. Medical Record Management.
18. Information and Communication (ICT) Technology system.
19. Policy of Quality Assurance.
20. OSHA, Sharp Management and Needle Stick Injury Policy and Guidelines.
21. Policy regarding public relations, release of information and confidentiality

Appendix A

LEVELS OF ICU CARE

ICU are categorised into 3 levels:

Level	Description
Level 1	This is equivalent to the HDU or acute care ward and shall be made available in all hospitals without anaesthesiologist. The unit shall have 4 – 6 beds and shall be capable of providing intensive monitoring and basic intensive care e.g. oxygen therapy and inotropic support but not mechanical ventilation. Nurse to patient ratio shall be 1:2 – 1:3 patients.
Level 2	This shall be located in hospitals with anaesthesiologists (minor specialist hospitals) capable of providing intensive care. The number of beds shall be 6 – 12 and the unit shall be capable of providing mechanical ventilation. Nurse to patient ratio shall be 1:2 for non-ventilated patients and 1:1 for ventilated patients.
Level 3	All state and major specialist hospitals shall have Level 3 ICUs with facilities for multiple organ support e.g. mechanical ventilation and renal replacement. Nurse to patient ratio shall be 1:1 or more in complex cases. The unit shall operate as a 'closed unit' directed by an intensivist or an anaesthesiologist with special interest in intensive care. The number of beds shall range from 16 – 35, or approximately 3 – 5% of total number of beds in the hospitals depending on the services provided by the hospital. The unit shall cater for both medical and surgical cases.

Appendix B

Antibiotic Protocol

HOSPITAL CANSELOR TUANKU MUHRIZ, UKM

General Intensive Care Unit

GICU Empirical Therapy. Send cultures before starting antibiotics!

	TYPE 1	TYPE 2 Low Risk : < 5 days admission High Risk : > 5 days admission	TYPE 3
Blood	IV Amoxicillin / Clavulanate If IVDU : IV Cloxacillin	IV Piperacillin/Tazobactam + IV Gentamicin (for 3 days only)*2	**If in Septic shock** IV Imipenem/Meropenem + IV Vancomycin* **Without shock** IV Piperacillin/Tazobactam ± IV Vancomycin*
Lung	IV Amoxicillin / Clavulanate + Azithromycin	IV Cefepime	High dose IV Ampicillin/Sulbactam Add on IV Meropenem [If CPIS score worsen and/or SOFA increase >2 from baseline]
Urine	IV Amoxicillin / Clavulanate	IV Piperacillin/Tazobactam	**If in Septic shock** IV Imipenem/Meropenem + IV Vancomycin* **Without shock or pyelonephritis** Nitrofurantoin*1 if CrCL > 30
Skin & soft tissue	IV Amoxicillin / Clavulanate	IV Piperacillin/Tazobactam ± IV Gentamicin (for 3 days only) *2	**If in Septic shock** IV Imipenem/Meropenem + IV Vancomycin* **Without shock** IV Piperacillin/Tazobactam ± IV Gentamicin If MRSA is strongly suspected*3, add vancomycin*

*1 *Nitrofurantoin NOT for pyelonephritis* *2 *Stop Gentamicin till culture review* *3 *Suspect MRSA if colonized with MRSA, previous MRSA infections within past 3 months.*

Continuing treatment	If the pathogen is sensitive or culture is negative & patient responds clinically; Consider ORAL switch if 1. T < 38 °C for >24 hours with clinical improvement AND 2. Orally tolerated, AND 3. No sign of sepsis AND 4. No high risk / deep seated infection.	De-escalate to narrowest spectrum antimicrobials if culture negative and clinically stable, consider 5-7 days duration *(*Strongly recommend ID consultation)*

TYPE 1 No contact with health care system in the last 90 days AND No prior antibiotic treatment in the last 90 days AND young Patient with no or few co-morbid conditions.

TYPE 2 Contact with health care system in past 3 months or < 1 week in the hospital or < 48hrs in ICU (eg. admission in hospital or nursing home), invasive procedure OR Recent antibiotic therapy in last 3 months OR elderly (> 65 years) with few co-morbidities.

TYPE 3 Hospitalization > 5-7 days ± infections following major invasive procedures OR Recent & multiple antibiotic therapies OR Elderly (> 65 years) + multiple co-morbidities (eg. structural lung disease, immunodeficiency).

TOP 5 Pathogens [GICU]

2014 – 2018

Blood (Top 5 is 55% of 614 blood-positive isolates)	Urine (Top 5 is 87% of 215 urine-positive isolates)
Klebsiella sp. [n=88 (14%); ESBL 41 (47%), CRE 4 (5%)]	Escherichia coli [n=58 (27%); ESBL 23 (40%), CRE 0 (0%)]
Acinetobacter sp. [n=72 (12%)]	Klebsiella sp. [n=43 (20%); ESBL 23 (53%), CRE 6 (14%)]
Staphylococcus aureus [n=63 (10%); MRSA 35 (56%)]	Enterococcus sp. [n=34 (16%); VRE 3 (9%)]
Pseudomonas aeruginosa [n=59 (10%)]	Pseudomonas aeruginosa [n=33 (15%)]
Enterococcus sp. [n=58 (9%); VRE 9 (16%)]	Acinetobacter sp. [n=19 (9%)]
Respiratory (Top 5 is 87% of 655 respiratory-positive isolates)	**Pus (Top 5 is 62% of 552 pus-positive isolates)**
Acinetobacter sp. [n=140 (21%)]	Klebsiella sp. [n=86 (16%); ESBL 30 (35%), CRE 4 (5%)]
Pseudomonas aeruginosa [n=135 (21%)]	Pseudomonas aeruginosa [n=78 (14%)]
Staphylococcus aureus [n=135 (21%); MRSA 40 (30%)]	Staphylococcus aureus [n=77 (14%); MRSA 28 (36%)]
Klebsiella sp. [n=124 (19%); ESBL 50 (40%), CRE 2 (2%)]	Acinetobacter sp. [n=59 (11%)]
Enterobacter sp. [n=39 (6%); ESBL 4 (10%), CRE 1 (2%)]	Escherichia coli [n=43 (8%); ESBL 13 (30%), CRE 2 (5%)]

Collaborative effort by HCTM Antimicrobial Stewardship Committee

Edition 3.0 | Last updated January 2023

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Admissions & Discharges for ICU

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INTRODUCTION

Appropriate utilisation of ICU facilities is important when healthcare expenditures are high with limited resources. This guideline intends to provide models of plans when formulating admission to, discharge from and triaging of ICU. As safeguard against COVID 19 pandemic, admission pathways should be used accordingly in order to contain the spread of infection especially among health care providers.

PRINCIPLES

The decision to admit a patient to ICU is based on the concept of potential benefit. Critically ill patients with a reversible medical or surgical condition, having a reasonable prospect of meaningful recovery should be admitted.

A combination of criteria should be used to determine ICU admission or discharge. ICU triaging is necessary to ensure optimal and equitable use of limited intensive care resources.

FACILITIES

General ICU

REFERRAL AND BOOKING FOR ADMISSION

ICU admissions are either from wards or emergency department. Referrals are for:

1. Perioperative stabilisation.
2. Organ support while empirical or definitive therapy is taking its effect.

Perioperative ICU bookings:

1. All operative bookings are to be informed directly to the team in charge of ICU; consultant/specialist/ registrar.

2. Intensive Care Unit booking form has to be completed (Appendix A). This form contains the patients' details, reason for ICU bookings and surgical procedures planned. The booking form is available in the ICU and the RICU on call will be in-charge to monitor the bookings.
3. Bookings of elective operative cases are to be done latest by the day prior to surgery. Emergency operative bookings are to be discussed with the ICU consultant/specialist at the earliest time possible.

Any critically ill patient should be referred to the ICU doctors. ICU situations are dynamic as is the availability of ICU beds. All referrals will be documented and followed up using the ICU referral form (Appendix B) or Peripheral Critical Care COVID review form (Appendix C). Cases will be discussed during handover rounds. Cases that are not admitted to the ICU will be documented on the Peripheral ICU board.

If an ICU bed is not available, the patient should be stabilised and transferred to other suitable area. It is the responsibility of the primary team to identify other critical care areas for the patient to be transferred to.

ADMISSION TO ICU

The admission to ICU is to be decided by the ICU consultant/specialist. Admission to GICU requires the latest COVID RTK result. Patients with positive COVID RTK tests will be admitted to Ward 7A (subject to change depending on the status of pandemic).

Upon admission to ICU, all patients require APACHE II form to be completed (Appendix D) and daily SOFA score to be documented (Appendix E).

1. Staffing of ICU beds.
    1.1. The KJ in charge of GICU will inform the attending doctor in ICU on the availability of ICU beds for that day.
    1.2. The RICU will notify the KJ in charge or nursing team leader (TL) of any proposed admissions.

2. Criteria for GICU admissions:
    2.1. The ICU consultant/specialist decides that the admission is necessary to provide optimal critical care therapies that cannot be provided in the ward.
    2.2. The patient's condition should be potentially reversible.
        - There are circumstances in which emergency treatment is already carried out e.g., intubation and extubation but there is no realistic

prospect of survival. In such a case, the primary team along with next of kin and family members will need to decide the direction of care.

2.3. Admissions are not for patients with non-critical conditions for whom ward care could reasonably be expected.

3. To optimise ICU resources and improve outcomes, ICU admissions should be guided based on these combination factors:
   3.1. Prioritisation according to the patient's severity of illness.
   3.2. Specific patient critical care therapies such as but not limited to mechanical ventilation or renal replacement therapy.
   3.3. Favourable diagnoses & prognoses.
   3.4. Potential benefit from interventions & objective parameters at the time of referral.
   3.5. Available clinical expertise & bed availability.

4. Decisions on admissions should be clinically appropriate and evidence-based. Most patients will fit into one of the following categories:
   4.1. Respiratory failure needing airway and ventilatory support.
   4.2. Multiorgan failures necessitating critical care therapies for at least two organ systems.
   4.3. The need for invasive/intensive monitoring and stabilisation, in anticipation of possible invasive and non-invasive intervention.
   4.4. Anticipated extended post-operative recovery, allowing abnormal perioperative physiology to reverse, with or without modulation of the normal stress response.
   4.5. Optimisation and control of chronic physiological or pathophysiological conditions to prevent further organ injury or decompensation for example but not limited to i.e. sleep apnoea post-operative.
   4.6. Ensuring maintenance of physiological reserve, especially when the reserve is minimal, in whom needing critical care therapies until the pathologies have been reversed and reserve restored.
   4.7. Instituting critical care therapies when overwhelming stress response to injury or inadequate compensation has occurred with major disruption to the physiology.

5. Prioritisation of the ICU admissions

1	Unstable patient in need of intensive treatment and monitoring that cannot be provided outside of the ICU. This includes ventilator support and vasoactive drug infusion. These patients have no limit placed on the extent of the therapy they are to receive.
2	Patients require intensive monitoring and potential for immediate intervention. No therapeutic limits are stipulated for this patient.
3	Unstable critically ill patients who have a reduced likelihood of recovery because of underlying disease or the nature of their acute illness. Patients may receive intensive treatment to relieve acute illness but limits on therapeutic efforts may be set, such as no intubation or resuscitation.
4	Patients who have irreversible medical or surgical conditions or poor physiological reserve to result in any improvement following critical therapies, are generally not appropriate for ICU admission.

6. Admission of the following patients should be on an individual basis, under unusual circumstances and at the discretion of the ICU consultant/specialist. These fall into two categories:
    6.1. Too well to benefit from intensive care management based on low risk. Examples given, but not limited to, are patients after peripheral vascular surgery, diabetic ketoacidosis with stable hemodynamic, mild congestive heart failure, and conscious drug overdose.
    6.2. Too sick to benefit from intensive care management based on conditions consistent with imminent death. Examples given, but not limited to, are patients with severe irreversible brain damage, irreversible multi-organ system failure, metastatic cancer unresponsive to therapy, patients with decision making capability who decline services typically provided by ICUs, comfort care only.

7. Transfers of patients from other hospitals to ICU.
    7.1. Referral from another hospital's ICU **should not** directly go to an ICU doctor. The primary team in HCTM should be contacted by the referring hospital. The referred primary consultant/specialist in HCTM should then discuss the

referral with the ICU consultant/specialist in charge regarding the transfer of care for ICU admission.

7.2. The transfer of ICU care is to be decided by the ICU consultant. If the transfer of care is accepted, the patient is to be transported by the referring hospital's team and transferred via the Emergency Department on arrival to HCTM and be seen by the primary team doctor there.

7.3. Transfer of care of critically ill patients from another hospital by the primary team in HCTM that is not discussed with and not accepted by the ICU consultant in charge will not be admitted to GICU directly.

8. The care of critically ill patients that are mechanically ventilated in other critical areas.
    8.1. The ICU consultant/specialist must be informed of any admission to other critical care areas (e.g., RICU, CCU, CICU and Burn Unit) or in the wards that require mechanical ventilation.
    8.2. The ICU team will assist in the management of the mechanical ventilation while the primary team will primarily care for the critically ill patient. If it is not informed or agreed upon, the primary team will be fully responsible for the patient's wellbeing.

DISCHARGE CRITERIA

The condition and progress of patients managed in the ICU should be reviewed continuously to identify patients who may no longer need ICU care. This includes but not limited to; when a patient's physiologic status has stabilised and the need for ICU monitoring and care is no longer necessary.

However, when a patient's condition deteriorates and/or becomes irreversible and active interventions are no longer beneficial, limitation and withdrawal of intensive care therapies should be discussed and decided between the ICU, primary team and any relevant supportive teams together with the family. The patient may be discharged following this multidisciplinary and shared decision.

The decision to discharge a patient shall be made by the ICU Consultant/specialist. Discharge will be based on the following criteria:

1. Stable hemodynamic parameters & respiratory status.
    1.1. Oxygen requirements not more than 60%.
    1.2. IV inotropic/vasopressor support and vasodilators are no longer necessary or on low dose inotropic support.
    1.3. Cardiac dysrhythmias are controlled.
2. Neurologic stability with control of seizures.

3. Patients who require prolonged ventilatory support either via invasive or noninvasive mechanical ventilation (for example but not limited to motor neuron diseases, cervical spine injuries, chronic obstructive airway disease, morbid obesity with OSA) with any of the acute critical problems reversed or resolved with or without tracheostomies.

Discharge forms (Appendix F) are to be completed before patients are transferred out from ICU. If the discharge is delayed for reasons of insufficient ward resources, this must be documented in case note.

Prior to discharge;

1. The primary team shall be informed of the management plan including any limitation of treatment which will be detailed in the Discharge form.
2. An ICU discharge summary will be done by the ICU resident.
3. Any limitation of treatment shall be clearly documented including why and amongst whom these decisions are made.
4. The primary team and family will be informed if the patient is transferred out from ICU. The ENT team will also be informed of the discharge if the patient has a tracheostomy.
5. The primary team will transport the patient from ICU to the ward and it is their responsibility to receive and review patients promptly in the ward upon arrival.
6. Patients who require a higher level of nursing care may benefit from admission to a step-down unit, if available.

DISCHARGE AGAINST MEDICAL ADVICE (DAMA) / DISCHARGE AT OWN RISK

The request of discharges of ill patients by family to home shall be considered as AOR and to be discussed with the primary team. Prior approval by the Hospital Director is requested by the primary team and an AOR form to be completed and signed (Appendix G). Arrangement and cost of the AOR transfer to home or any other destination planned by the family is to be done by the patient's family.

Appendix A

Department of Anaesthesiology & Intensive Care, HCTM

ICU BOOKING FORM FOR PERIOPERATIVE CARE

Date: …… ICU Consultant/ Specialist: ……..

No.	Name, MRN & Ward	Discipline & Surgeon	Diagnosis, Procedure & Date of surgery	Type of Surgery (*E/SE/EL)	Indication For ICU	Request Letter (Yes/No)	Booked by	Accepted (Yes/No)

**E: Emergency, SE: Semi-Emergency, EL: Elective*

Appendix B

<table>
<tr><th colspan="3">UKMMC GICU NON- INVASIVE VENTILATION REFERRAL FORM</th></tr>
<tr><td rowspan="2">Patient’s sticker</td><td>Referral (Date/Time):</td><td rowspan="2">Outcome (tick):
☐ Sucessfully weaned
☐ Required intubation
☐ Others:</td></tr>
<tr><td>Discharge (Date / Time):</td></tr>
<tr><td colspan="3">Referring department (tick): Please specify unit in space given</td></tr>
<tr><td>☐ Medical:
☐Oromaxillofacial
☐Opthalmology</td><td>☐ Surgery:
☐ Otorhinolaryngology
☐ Oncology</td><td>☐ Orthopedic:
☐ O&G:
☐ Others:</td></tr>
<tr><td colspan="2">Specialist ICU in-charge /on-call:</td><td>Reason of referral:</td></tr>
<tr><td>Relevant history & physical examination upon referral:</td><td>Referring investigations:</td><td>Referring ABD:
pH
pO2
pCO2
HCO3
BE
Lactate</td></tr>
<tr><td colspan="2">Management/ Orders:

Sign & Stamp:</td><td>Type NIV:

Location NIV:
☐ General Ward
☐ Acute Ward
☐ HDW/ HDS
☐ Others:</td></tr>
</table>

<table>
<tr><th colspan="4">UKMMC GICU NON-INVASIVE VENTILATION FORM
PATIENT'S PROGRESS FORM</th></tr>
<tr><td>Day:
Date:
Time:

☐ Active
☐ Max NIV
☐ NAR
☐ Unsure</td><td>History&
Examination</td><td>Investigations
pH:
pO2:
pCO2:
HCO3:
Lactate:
BE:
Others:</td><td>Mode
☐ CPAP
☐ BiPAP
☐ Others:
Setting:
EPAP:
IPAP:
FiO2:
Others:</td></tr>
<tr><td>Day:
Date:
Time:

☐ Active
☐ Max NIV
☐ NAR
☐ Unsure</td><td>History&
Examination</td><td>Investigations
pH:
pO2:
pCO2:
HCO3:
Lactate:
BE:
Others:</td><td>Mode
☐ CPAP
☐ BiPAP
☐ Others:
Setting:
EPAP:
IPAP:
FiO2:
Others:</td></tr>
<tr><td>Day:
Date:
Time:

☐ Active
☐ Max NIV
☐ NAR
☐ Unsure</td><td>History&
Examination</td><td>Investigations
pH:
pO2:
pCO2:
HCO3:
Lactate:
BE:
Others:</td><td>Mode
☐ CPAP
☐ BiPAP
☐ Others:
Setting:
EPAP:
IPAP:
FiO2:
Others:</td></tr>
<tr><td>Day:
Date:
Time:

☐ Active
☐ Max NIV
☐ NAR
☐ Unsure</td><td>History&
Examination</td><td>Investigations
pH:
pO2:
pCO2:
HCO3:
Lactate:
BE:
Others:</td><td>Mode
☐ CPAP
☐ BiPAP
☐ Others:
Setting:
EPAP:
IPAP:
FiO2:
Others:</td></tr>
</table>

Appendix C

DEPARTMENT OF ANAESTHESIOLOGY & INTENSIVE CARE HCTM PPUKM
Peripheral Critical Care COVID-19 review

Date & time of review: **MO in-charge:**
Location: **Specialist/Consultant in-charge:**

Please tick ☑ boxes.

Name:
Sex: ☐ M, ☐ F **Age (yrs):**
NRIC/Passport:
MRN:

Weigh (kg):
Height (cm):
BMI (kg/m²):
Nationality: ☐ MY, ☐ foreigner
Vaccine name:
1st vaccine:
2nd vaccine:

Date/Day of Illness:
Date of Admission:
Date of ICU referral:
Date of discharge:
Date of death:

COVID-19 test date:
RTK:
Rapid Mol.:
PCR:

Primary team: ☐ Medical, ☐ others:
Past medical history: ☐ no comorbidities
☐ DM, ☐ HTN, ☐ IHD, ☐ CCF, ☐ CKD, ☐ ESRF, ☐ obesity, ☐ smoking
☐ others:

Medications:

Diagnosis & Progress:
1. **COVID-19 pneumonia category:** □ 4A, □ 4B, □ 5
   day of illness:
   ☐ organising pneumonia, ☐ pulmonary embolism

Inotropic support:
☐ no, ☐ noradrenaline (µg/kg/min):

O_2 support:
☐ VM, ☐ HFM, ☐ HFM+NP, ☐ HFNC,
☐ NIV, ☐ SIMV
Setting: FiO_2: PEEP: PC: Vt:
PS: rate: flow:
Generated: Vt: Ppeak:

Vital signs:
BP:
HR:
RR:
SpO_2:
Temp:
I/O:

ROX Index:

Medication:

	Dose/Frequency
IV methylpred.	
tab prednisolone	
tab dexamethasone	
tab baricitinib	
tab favipiravir	
tab ascorbic acid	
tab tofacitinib	
tab esomeprazole	
SC enoxaparin	

Antibiotics:

Others:

Blood investigation:

Date			**Date**			**Date**		
Hb			CrCL			PCT		
Plt			Alb			ferritin		
WCC			ALP			LDH		
ALC			ALT			CRP		
Na			Bili			D-dimer		
K			CoCa			INR		
urea			Mg			Trop I		
Creat			PO_4			Dxt		

ABG:

Time	pH	pCO_2	pO_2	HCO_3	BE	Lact	P:F

Cultures: **Other Ix:**

Imaging:
1. **HRCT/CTPA date:**

Plan:
Signature/Official Stamp:

Appendix D

GICU UKMMC APACHE II FORM

Please keep this APACHE II form in the APACHE file in ICU.

This form does not follow patient's notes upon discharge from ICU

Patient's sticker	
Date of Hospital Admission:	Date of ICU Admission:
Date of Hospital Discharge:	Date of ICU Discharge:
Primary Team Admission:	Primary Team Discharge:
ICU Diagnosis at Admission to ICU:	ICU Diagnosis at Discharge from ICU:
Reason for ICU Admission:	
ICU outcome: (Filled by MO)	If Death, state cause:
Hospital Outcome: (Filled by Specialist)	If Death, state cause:
Form completed by (Name of MO)	Date, sign and stamp:

The APACHE II Severity of Disease Classification System

Physiologic Variable	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature - rectal (°C)	≥41	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	≤29.9
Mean Arterial Pressure (mm Hg)	≥160	130-159	110-129		70-109		50-69		≤49
Heart Rate	≥180	140-179	110-139		70-109		55-69	40-54	≤39
Respiratory Rate (nonventilated or ventilated)	≥50	35-49		25-34	12-24	10-11	6-9		≤5
Oxygenation (mmHg) a. $FiO_2 > 0,5$ use $A\text{-}aDO_2$ b. $FiO_2 < 0,5$ use PaO_2	a ≥500	350-499	200-349		<200				
	b				> 70	61-70		55-60	<55
Arterial pH	≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
Serum Sodium (mmol/l)	≥180	160-179	155-159	150-154	130-149		120-129	111-119	≤110
Serum Potassium (mmol/l)	≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5
Serum Creatinine (mg/dl, Double point score for acute renal failure)	≥3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
Hematocrit (%)	≥60		50-59.9	46-49.9	30-45.9		20-29.9		<20
White Blood Count (in 1000/mm³)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
Glasgow-Coma-Scale (GCS)	Score = 15 minus actual GCS								
Serum HCO_3 (venous, mmol/l, use if no ABGs)	≥52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15
A = Total Acute Physiology Score APS	Sum of the 12 individual variable points								

B = Age Points		**C = Chronic Health Points**
≤44 years	0 points	If the patient has a history of severe organ system insufficiency or is immunocompromised assign points as follows:
45-54 years	2 points	a. For nonoperative or emergency postoperative patients – 5 points
55-64 years	3 points	b. For elective postoperative patients – 2 points
65-74 years	5 points	
≥75 years	6 points	

APACHE II Score = Sum of A (APS points) + B (Age points) + C (Chronic Health points)

(From: Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med 1985;13(10):818-29)

Appendix E

Sequential Organ Failure Assessment Score

Patient's sticker

ICU Admission date: _____ ICU Day: ____
Form filled date: _____
ICU Discharge date: _____

GICU UKMMC Sequential Organ Failure Assessment (SOFA) FORM

This form to be completed on admission and daily until patient is discharged.
The worst values for each parameter within the 24-hour period upon assessing are used.
Forms to be collected and kept in the SOFA folder upon patient's discharge.

System	Score					Scored
	0	1	2	3	4	
Respiration PaO2/FIO2, mm Hg	≥400	<400	<300	<200 with respiratory support	<100 with respiratory support	
Coagulation Platelets, ×103 /µL	≥150	<150	<100	<50	<20	
Liver Bilirubin, µmol/L	<20	20-32	33-101	102-204	>204	
Cardiovascular	MAP ≥70 mmHg	MAP <70 mmHg	Dopamine <5 or Dobutamine (any dose)	Dopamine 5.1-15 or adrenaline ≤0.1 or noradrenaline ≤0.1	Dopamine > 15 or adrenaline > 0.1 or noradrenaline > 0.1	
			Catecholamine doses are given as µg/kg/min for at least 1 hour			
Central Nervous System Glasgow Coma Scale score	15	13-14	10-12	6-9	<6	
Renal Creatinine, µmol/L or Urine output, mL/day	<110	110-170	171-299	300-440 or <500 ml/day	>440 or <200 ml/day	
					Total score (sum of all above scored)	

Adapted from: Vincent JL, Moreno R, Takala J *& et al.* Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. Intensive Care Med 1996; 22(7): 707-710.

Appendix F

(Pln.01/11/14)

GENERAL INTENSIVE CARE UNIT PUSAT PERUBATAN UKM **DISCHARGE SUMMARY**	PATIENT IDENTIFICATION LABEL NAME: MRN: AGE: GENDER:
Admission Date To ICU: ___/___/___ Receiving Unit-Team Notified: ☐ Dr_____	Discharge Date From ICU: ___/___/___ APACHE Score on admision: ☐
ICU ADMISSION DIAGNOSIS:	
CO-MORBIDITES:	
CLINICAL SUMMARY:	
DISCHARGE MEDICATION:	
ANTIBIOTIC THERAPY: Started: Due To Stop: Indication	
DISCHARGE PLAN:	
NAME: SIGNATURE: STAMP:	

Appendix G

HOSPITAL CANSELOR TUANKU MUHRIZ, UKM

SURAT AKUAN KELUAR DARI HOSPITAL ATAU KEMAHUAN PESAKIT SENDIRI / SUAMI / ISTERI / PENJAGA / KELUARGA TERDEKAT.

Saya _____ No. K / P : _____
(*nama*)

adalah pesakit * sendiri / suami / isteri / penjaga / keluarga terdekat kepada pesakit ingin keluar / membawa keluar pesakit _____
(*nama pesakit*)

No. K / P : _____ dari hospital _____ pada _____

Saya mengakui bahawa tindakan saya ini adalah bertentangan dengan nasihat doktor dan saya difahamkan tentang risiko tindakan saya ini.

Saya akan bertanggungjawab sepenuhnya ke atas perkara yang mungkin berlaku akibat tindakan saya.

Tandatangan : _____ Nama Saksi : _____
atau * (Pesakit / Suami / Isteri
Cap Jari Penjaga / Keluarga terdekat)

Pekerjaan : _____ No. K / P : _____

Alamat : _____ Pekerjaan : _____

_____ Tandatangan : _____

Tarikh : _____ Tarikh : _____

Nama Doktor yang bertugas : _____

No. K / P : _____ Tandatangan : _____ Tarikh : _____

UNTUK KEGUNAAN WAD

Pesakit telah dikeluarkan pada : _____
(*Tarikh dan Jam*)

Tandatangan Jururawat bertugas : _____ Tarikh : _____

* *Potong yang tidak berkenaan*

HCTM/ RP 65/97 (Pin.1/2020)

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4. Bion J & Dennis A. ICU Admission and Discharge Criteria. Oxford Textbook of Critical Care. Oxford University Press Print Publication. Apr 2016. ISBN-13: 9780199600830.
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High Flow Nasal Oxygen Therapy

Associate Professor Dr Aliza Mohamad Yusof, Associate Professor Dr Raha Abdul Rahman, Associate Professor Dr Azarinah Izaham, Associate Professor Dato' Dr Wan Rahiza Wan Mat, Dr Cheah Saw Kian, Dr Low Hsueh Jing, Dr Mohd Khazrul Nizar Abd Kader

INTRODUCTION

High Flow Nasal Oxygen therapy is an air-oxygen blender that allows delivery of high flow (30 – 60 L/min) of heated and humidified gas at predictable FiO2 between 0.21 to 1.0. The gas is heated and humidified through an active heated humidifier and delivered via a single-limb heated inspiratory circuit.

Usage of HFNC is only limited to patients in GICU.

ADVANTAGES OF HFNC OXYGEN THERAPY

1. **High flow** – permits constant oxygen delivery; washout nasopharyngeal dead space and decreases dead space.
2. **CPAP effect** – mechanical splinting of the nasopharynx prevents supraglottic collapse and decreases nasopharyngeal resistance; provide low levels of PEEP that contribute to alveolar recruitment (decreased dead space), improved compliance and decreased work of breathing (to overcome iPEEP).
3. **Humidification** – heated humidified gas flow preserves nasal mucosa and allowing high flows; enhanced mucocilliary function.

CONTRAINDICATIONS

1. Hypercapnic respiratory failure
2. Epistaxis
3. Base of skull fracture
4. Surgery to the nose or upper aero-digestive tract
5. Nasal obstruction e.g. nasal fracture, tenacious secretions, tumour
6. Facial anomaly (e.g. choanal atresia)

RECOMMENDATIONS FOR HFNC

Strength	Recommendations
Strong	• Acute hypoxemic respiratory failure
Conditional	• High risk patients following extubation, who are intubated for > 24 hours. High risk features such as – age> 65 – Congestive heart failure – Moderate-severe COPD – APACHE II score> 12 – BMI>30 – Airway patency and secretion problem – Difficult weaning – > 2 comorbidities – Duration of mechanical ventilation > 7 days • Postoperative high risk and/or obese patients following cardiac or thoracic surgery
No recommendation	• Peri-intubation period (moderate certainty)

CANNULA SELECTION

1. Cannula used to deliver high flow do not require a seal to function and therefore have prongs with smaller diameter and length than interfaces designed for CPAP.
2. Recommendations are for the cannula to occupy approximately 50% of the internal diameter of the nares to permit some leak and prevent excessive airway pressure.
3. The distance between the prongs should be wide enough to avoid pinching the nasal septum.

METHOD OF DELIVERY

1. Select appropriate size of cannula and circuit for the patient (specific to the device).
2. Connect bag of sterile water to heater/ humidifier.
3. The water bag must run freely and be placed as high above the humidifier to achieve flow of water into the humidifier chamber.

4. Turn on heater/ humidifier and allow to warm up before use.
5. Select non-invasive mode and set temperature at 37°C.
6. Always use an air-oxygen blender, never use flow meter off wall delivering FiO_2 100%.
7. Set FiO2 (from 21% to 100%).
8. Maximum oxygen flow rate up to 60 L/min in adults.
9. Low setting: 0.5 L/kg/min.
10. High setting: 1 L/kg/min.
11. Start with flow rate of 30 L/ min then increase up to goal flow rate target.
12. Place nasal cannula on patient — ensure cannula fits snugly in the patient's nares.
13. Prongs should not totally occlude nares.
14. Titrate FiO2 and flow rate as required.
15. Monitor for ROX index.

PARAMETERS TO MONITOR WHILE ON HFNC

1. SpO2 ≥ 92%
2. Reduced work of breathing or RR < 30 breaths/min
3. Increased in PaO_2/FiO_2 ratio > 20% from original value
4. ROX index = SpO_2/ FiO_2 (%)/RR

Parameter	Initiation	1 H	2 H	4 H	6 H	12 H	24 H
Flow							
FiO2							
GCS							
BP							
HR							
RR							
SpO2							
ROX index							
PaO2							

POSSIBLE COMPLICATIONS ON HFNC

1. Local trauma, discomfort and pressure areas
2. Epistaxis
3. Gastric distension
4. Blocked cannula due to secretions
5. Failure of HFNC might cause delayed intubation and worse clinical outcomes in patients with respiratory failure

POINTS TO CONSIDER SHORTLY AFTER INITIATION OF HFNC

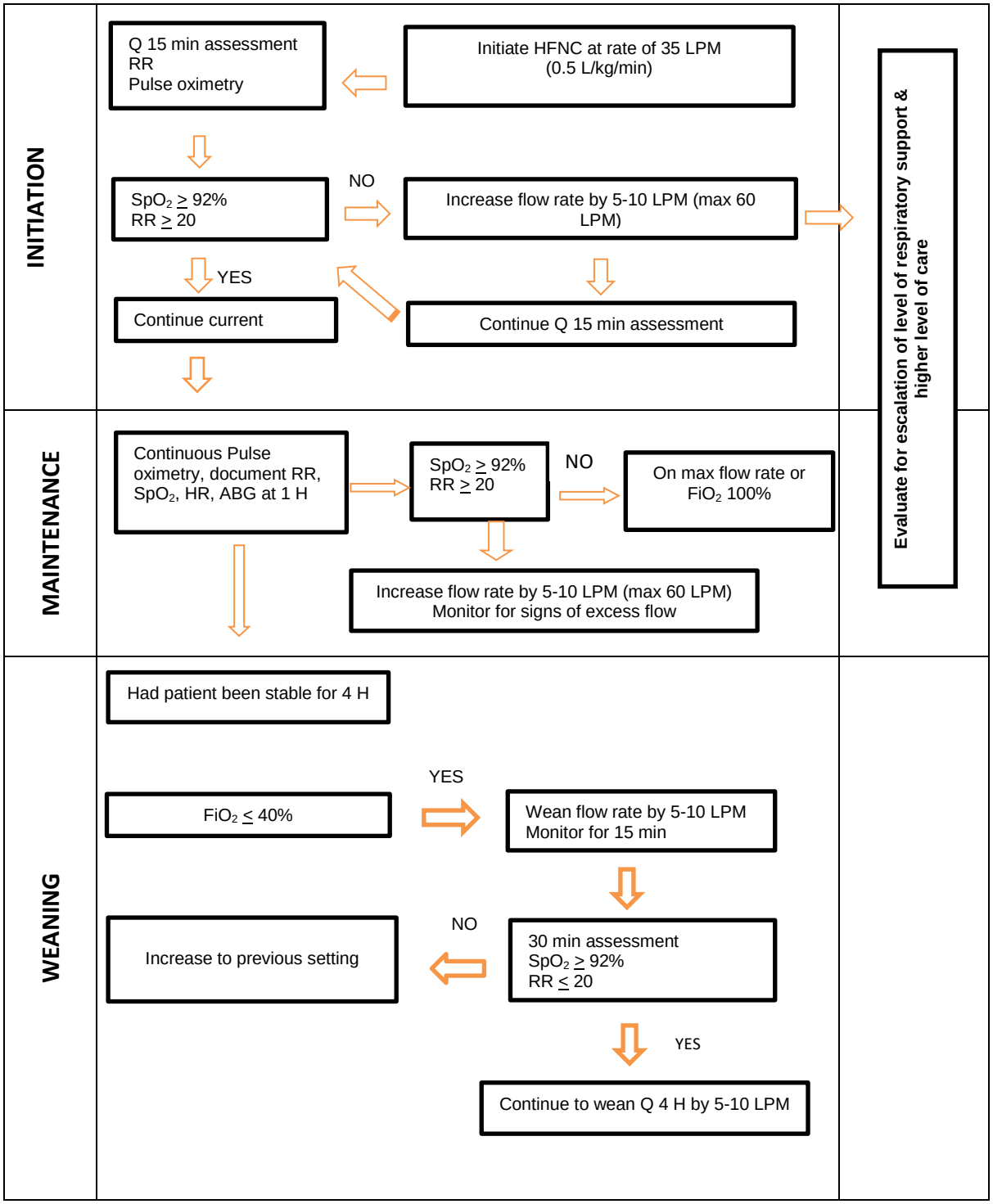
1. Attempt a short trial (1 hour) and intubate in case the patient acutely deteriorates, does not improve or lack of evidence of improvement within 24-48 hours.
2. **Monitoring of ROX index = SpO_2/ FiO_2 (%)/RR**
   If ROX index ≥ 4.88 at 2, 6, 12 hours after HFNC, risk of intubation is low.
   If ROX index < 3.85, risk of HFNC failure is high and intubating patients should be discussed.

Checklist for HFNC

A YES response to any of the following should prompt consideration for intubation.

	Yes	No
Does this patient require immediate intubation?		
Are relative contraindications for HFNC present? (e.g. hypercapnia, airway protection, obstructed nasal passage, aspiration risk)		
Has the patient's hypoxia failed to improve with HFNC?		
Has the patient's work of breathing failed to improve with HFNC?		
Is patient hemodynamically unstable?		

HFNC INITIATION, MAINTENANCE AND WEANING PATHWAY



HFNC IN COVID-19 INFECTION

1. WHO guideline 2023 recommend that hospitalized patients with severe or critical COVID-19 and acute hypoxaemic respiratory failure not needing emergent intubation, suggest high-flow nasal oxygen rather than standard oxygen therapy (conditional recommendation).
2. HFNC oxygen therapy is considered an aerosol-generating procedure. Thus, appropriate infection control precautions are required when it is being administered to patients with unknown or positive COVID-19 status.
3. Place a surgical mask on the patient while using HFNC, when health care workers are in the room or the patient is being transported.

REFERENCES

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2. Rochwerg, B., Granton, D., Wang, D.X. et al. High flow nasal cannula compared with conventional oxygen therapy for acute hypoxemic respiratory failure: a systematic review and meta-analysis. Intensive Care Med. 2019;45:563–572.
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4. Roca O et al. Predicting success of high-flow nasal cannula in pneumonia patients with hypoxemic respiratory failure: The utility of the ROX index. Crit Care. 2016;35:200-5.
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7. WHO, Clinical Management of COVID-19 Patient, Living Guideline. June 2022.

Workflow & Job Description for COVID-19 ICU

Associate Professor Dr Aliza Mohamad Yusuf, Associate Professor Dato' Dr Wan Rahiza Wan Mat, Associate Professor Dr Raha Abdul Rahman, Dr Cheah Saw Kian, Dr Low Hsueh Jing, Dr Mohd Khazrul Nizar Abd Kader

Remark: At the time of writing, COVID ICU is no longer operational. However, this guideline may act as a reference for management of highly contagious airborne diseases in future.

INTRODUCTION

The job description outlines the clinical services and workflow required to ensure smooth operation of COVID ICU. It is applied to specialists and MOs working in COVID ICU, including those who do not have prior anaesthesia training or experience but are required to provide services in this unit.

COVID INTENSIVE CARE TEAM

It comprises of the following personnel:

1. Consultant Intensivist and / or Consultant Anaesthesiologist.
2. Anaesthesiologist and / or Non-Anaesthesiologist Specialist.
3. Medical Officer which includes:
    - 3.1 Anaesthesiology and Critical Care postgraduate trainee.
    - 3.2 Non-Anaesthesiology postgraduate trainee and Service MO.
4. ICU pharmacist.
5. Nurse
    - 5.1 Critical care - trained nurse.
    - 5.2 Non-critical care – trained nurse.

GENERAL OPERATION POLICY

1. The general management of COVID-19 patients should reflect routine intensive care practices and following intensive care service policy by HCTM.
2. Coordinated and multidisciplinary management between the intensivist and/or anaesthesiologist, the infectious disease physician and the hospital administrator is important.

3. Specific management of COVID-19 patients can be referred to the HCTM COVID-19 Management consensus.

COVID INTENSIVE CARE SERVICES

1. It is divided into:
    1.1. COVID ICU service.
    1.2. Peripheral COVID services.
2. The allocation of services could change in time according to the situation and severity of COVID pandemic in this country.
3. The description of services is as follows:
    3.1. COVID ICU
        - As designated by hospital management.
        - All patients are managed by an intensive care team exclusively and referral to other specialties when required.
    3.2. Peripheral COVID
        - Ward and other critical care areas.
        - All patients are managed by the primary team exclusively.
        - Intensive care team is responsible for ventilation therapy and assisting the primary team when the need arises.

COVID ICU WORKFLOW

Daily schedule and workflow (number of shifts varies with COVID service requirement)

TIME	ACTIVITY
0800H – 0900H	Departmental activity (CME, M&M, Journal club) or Teaching (Tutorial/ Lecture)
0900H – 1100H	• Attendance, division of team into COVID ICU and Peripheral ICU • Briefing on workflow. • Handover of cases between post-call team and AM-shift/on-call (Consultant and Registrar) team. • The post-call team updates family members after hand-over and the shift is complete after completion of phone updates. Venue: ICU Handover Room

1100H – 1500H	COVID ICU and Peripheral COVID patient review and execution of tasks that were planned and decided during handover discussion.
1500H – 1600H	Handing over cases between AM-shift to PM-shift and on-call team. Venue: ICU Handover Room
1500H – 2100H (PM-shift MO) 1500H – 0800H (Specialist on-call)	• COVID ICU and Peripheral COVID ICU patient review, follow- up of plans and continuation of care by the PM-shift and on- call team. • Managing new referrals.
2000H – 2100H (MO)	Handing over of cases between PM-shift to night-shift & on-call team and update of new cases referred to Specialist on-call. Venue: ICU Handover Room
2100H – 0800H (MO)	• COVID ICU patient review and continuation of plan. • To address any life-threatening emergencies and stabilisation of new cases. The early morning reviews are required for COVID ICU and Peripheral COVID for preparation of the coming morning hand over.

The estimation of time in the schedule varies according to the difficulty of cases and the number of referrals needed to be attended.

The division of team is as follows (subject to change according to case load):

<table>
<tr><td>AM Team
(0800H – 1600H)</td><td>ICU
Consultant
Specialist
MO</td><td rowspan="3">ICU Consultant on-call
(0800H – 0800H)
24H</td></tr>
<tr><td>PM Team
(1500H - 2100H)</td><td>On-call
Specialist
MO</td></tr>
<tr><td>ON-CALL Team
Specialist
(1500H – 0800H)
RICU
(0800H – 0800H)

COVID NIGHT Team
(2000H – 0800H)</td><td>On-call Specialist
On-call RICU
MO</td></tr>
</table>

Doctors who are stationed in COVID ICU must be familiar with the workflow and management protocol designed for COVID patients.

1. Floor plan according to designated COVID ICU area.
2. Donning and Doffing.
3. Level of PPE.
4. Care of Powered Air-Purifying Respirator.
5. Management of Aerosol Generating Procedure.
6. Transportation of the COVID-19 patient.
7. HCTM COVID-19 Management Consensus.
8. ICU care bundle.
9. Flow Chart: Death in SARI/COVID ICU for SARI & confirmed positive COVID-19 infection.

The above information is available in the guideline booklet. This booklet can be accessed from the nursing counter or in the KJ room

JOB DESCRIPTION

1. Intensive Care Consultant (Consultant Intensivist and /or Consultant Anesthesiologist)
    1.1. The overall dynamics of the ICU team.
    1.2. The consultation, formulation of patient management and review in COVID ICU.
    1.3. The consultation and formulation of patient management for Peripheral COVID, whenever appropriate.
    1.4. Receiving and deciding of new referral cases during office hours.
    1.5. Division of manpower on the day of in-charge.
    1.6. Decision of admission and bed mobilisation for COVID ICU.
    1.7. Troubleshooting of any issues in difficult cases, in relation to patient management and family communication.
    1.8. Decision on implementation of end of life care.
    1.9. Preparation of COVID death report in collaboration with infectious disease physicians.
    1.10. Update the summary of daily COVID census.

2. Specialist (Anaesthesiologist and/or Non-Anaesthesiologist)
    2.1. Participate actively and be involved in the morning, afternoon and night hand over sessions by the COVID ICU team.
    2.2. Decide and follow-up on treatment plan of COVID ICU patient.
    2.3. Clinical review of COVID ICU patients, including patient medication, analysis of laboratory and imaging tests.
    2.4. Assist and perform certain difficult procedures such as positioning of patients (prone) in the obese, insertion of difficult invasive lines etc.
    2.5. Review new admissions in COVID ICU.
    2.6. Receiving and deciding on new referral cases after office hours.
    2.7. Decision of admission and bed mobilisation after office hour.
    2.8. Formulate treatment plan for Peripheral COVID whenever appropriate.
    2.9. Involve in the management of life-threatening emergencies and difficult airways.
    2.10. Referring COVID ICU patients to other specialties for further co-management.
    2.11. Oversee overall management formulated by the Registrar.
    2.12. Handover of the cases to ICU Consultant in-charge before formal hand over in the morning.
    2.13. Inform the consultant on-call when unexpected deterioration or deaths in COVID ICU.
    2.14. Involve in discussion of patient M&M meetings.
    2.15. Inform consultant on-call when further advice is needed in patient management, family communication and any potential medico-legal issues.

2.16. Inform daily census of critically ill patients referred for ICU care in both COVID and GICU to the HOD.

3. Non-Anaesthesiologist specialist
    3.1. This job description is applied when working in COVID ICU.
    3.2. The working hours are as stated in the schedule. Any issues related with working hours, he/she need to inform the Head of COVID ICU team.
    3.3. Tagging system using the *Buddy System* is implemented with the Anaesthesiologist to ensure safety in management practices. Discussion with the assigned *Buddy*- Anaesthesiologist is expected especially when unsure of the workflow or to perform the best clinical decision for the patient.
    3.4. When COVID ICU MO and/or RICU during on-call shift consults, formulation of plan is required as the Anaesthesiologist on call is also responsible for GICU patients. Hence, the non-anaesthesiologist specialist is the first line of consultation. Discussion with the *Buddy*- Anaesthesiologist should be done when there are uncertainties regarding bed mobilisation and clinical practices.
    3.5. Active work during AM-shift and on-call shift is expected, along with the *Buddy*-Anaesthesiologist. Ensuring contactability at all times during the shift.
    3.6. Certain procedures such as intubation can only be performed by trained specialists in advance resuscitation background.
    3.7. Procedures involving insertion of invasive lines can only be performed by specialists trained in this skill.
    3.8. Basic and life-saving skills such as insertion of chest drain and CPR shall be performed by all specialists with different specialties.

4. Medical officer (Anaesthesiology registrar, Anaesthesiology and Critical Care trainee, Non-Anaesthesiology trainee and Service MO)
    4.1. Review of patients in COVID ICU is performed by the RICU on-call and the AM-shift, PM-shift as well as Night-shift MOs in-charge of COVID ICU.
    4.2. Review of patients in Peripheral COVID ICU as well as handling of new referrals is performed by the AM-shift, PM-shift and Night-shift MOs in- charge of Peripheral COVID.
    4.3. The RICU of COVID ICU is the team leader of the MO team. They are in-charge of overall COVID ICU patients. Under the supervision of ICU Consultant and/or Specialist, they are responsible for:
        - Formulating the plan of care for the newly referred patients, assessment shall include a full history, physical examination and whether admission to the ICU will benefit the patient.
        - Performing necessary technical procedures as appropriate with the knowledge of the Registrar, depending upon the urgency and indication of the procedure and should be documented in the patient's case notes.

- Performing night rounds of in-patients and ensuring that the plan of care during daytime is implemented and to monitor changes of patient condition which may require a change or modification of the care plan. The change of plan and patient progress shall be informed to the on-call specialist.
- Deciding on patient mobilization, potential discharge after discussing with the on-call Specialist (after office hours) or with the attending ICU Consultant/Specialist during rounds.

4.4. The MO must have in-depth knowledge of the patient's medical history and diagnoses, progression of condition including ongoing/new issues and able to present fluently at handover rounds to the attending ICU Consultant/Specialist using a system-based approach. Documentation is done electronically in the Google Drive and manually in the patient case note. They are required to:

- Detailed clerking and examination of new cases will be documented in the electronic template in COVID ICU Google Drive.
- Perform an initial assessment and familiarise with patient diagnoses, hospital course and ongoing/new issues prior to morning handover. Information saved in the COVID ICU Google Drive will be referred to and amended during handover.
- Act as the primary physician liaison to the nursing and allied health staff.
- Perform a thorough physical examination on each of the assigned patient(s) each day.
- Document the summary of active issues, physical assessments and plan of care in detail in the patient case notes. Documentation shall be followed with clear and written name, designation and MMC number and stamped.
- Follow-up necessary lab and imaging test results. Document blood investigation results including cultures in the appropriate investigation flow chart and culture form respectively in the electronic chart in COVID ICU Google Drive and the physical chart.
- Perform regular daily reassessment of the assigned patients to ensure that the plan of care is implemented and to modify when necessary according to patient condition.
- Update daily progression and investigation results prior to each handover session. Immediately inform regarding new patient issues and change of patient condition to the RICU or attending ICU consultant/specialist.
- Perform regular daily reassessment of the suitability in initiating anticoagulants for deep vein thrombosis prophylaxis and patient mobilization.
- Provide updates to patients and their family members and participate in

formal family meetings upon requests by the COVID ICU team either online or face to face if permitted.

- Perform admission assessment on new patients admitted to COVID ICU with the assistance of the RICU and supervised by ICU Consultant/Specialist. Assessment shall include a full history, physical examination, completion of admission notes and admission order set manually in the patient case notes and later to be duplicated in the Google Sheet template in the COVID ICU Google Drive.
- Complete APACHE score assessment for new admissions.
- Update daily COVID ICU census electronically.
- Complete discharge summaries.
- Inform patient death to the primary team for completion of death certificate and police report.
- Perform the Last Office process including extubation after confirmation of death according to the Flow Chart of Death in COVID ICU, HCTM guideline.

4.5. The MO need to perform necessary technical procedures as appropriate to the trainee's knowledge and ability, depending upon urgency and stability of the procedure. The procedure performed should be documented in the patient case notes. The MO shall be able to perform routine procedures in COVID ICU with or without supervision including:

- Insertion of IV access.
- Blood culture and sensitivity.
- Intra-arterial cannulation for continuous blood pressure monitoring and serial blood sampling.
- Central venous cannulation with ultrasound guidance.
- Prone positioning and ventilation.
- Point of care ultrasonography.
- Intubation and extubation.
- Applying HFNC or NIV on patients.
- Chest tube insertion.
- Transport of the critically ill COVID patients.

4.6. The Peripheral COVID MO shall respond immediately to appropriate ICU referral. Indication for referrals can be for COVID ICU admission, increasing oxygen requirement and initiation of self-prone therapy with possibility of intubation, transport or sedation of critically ill COVID patients and patient resuscitation. All referrals/admissions shall be discussed with ICU Consultant/Specialist-in-charge during office hours or Specialist on-call after office hours.

4.7. The MO on-duty in each shift shall continue the review of Peripheral COVID

patients whenever appropriate and respond to the new referral. The Night-shift MO must handover and brief the team on the following morning regarding new referrals, pending admission(s) to COVID ICU, change of patient management plan etc.

4.8. The MO is at least certified BLS provider and/or ACLS provider.

4.9. As a safeguard against COVID-19 pandemic, no visitors are allowed into COVID ICU. Thus, it is our role to update daily patient progression to family members using hospital telephone. To ease the process, post- call teams are responsible to do so. All updates must be documented and stored in folders in the handover room.

4.10. All discharges shall be discussed with the COVID ICU consultant/specialist and the process of disposition shall be informed to the Infectious Disease Team or the primary admitting unit/ward.

5. Non-Anaesthesiology postgraduate trainees

5.1. This job description is applied when rostered in COVID ICU.

5.2. The working hours are as stated in the schedule and required to be present during the allocated time.

5.3. The rostered non-anaesthesiology postgraduate trainees are required to tag, using Buddy System with the rostered Anaesthesiology and Critical Care postgraduate trainees to ensure safety in management practices. In the weekly roster, the names of the rostered non-anaesthesiology and Anaesthesiology and Critical Care postgraduate trainees will appear as a pair. Patients are allocated during the shift. The transport of critically ill COVID patients will include one Non-Anaesthesiology trainee and the Buddy. Discussion should be done with the Buddy-Trainee when any uncertainties arise in regards to the workflow or to perform the best clinical decision for the patient.

5.4. Active duty is expected either at AM-shift, PM-shift or Night-shift, along with the Buddy-Trainee. Discussion and verbal orders over the phone with in-charge staff nurses without patient review is not an acceptable practice in managing the critically ill and shown to increase mortality rate. Ensure contactability at all times during the shift.

5.5. Certain procedures such as intubation and extubation can only be performed by a trainee trained in advanced resuscitation and airway management background.

5.6. Procedures involving insertion of invasive lines can only be performed by trained trainees.

5.7. Basic and life-saving skills such as insertion of chest drain and CPR shall be performed by all trainees with different background specialty.

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