	TITLE	MM 5.4: STANDARD INTRAVENOUS DRUG CONCENTRATION FOR ADULT INTENSIVE CARE UNIT AND EMERGENCY ROOM RESUSCITATION		
	APPROVAL DATE	DECEMBER 25, 2020	APPROVED BY	PHARMACY AND THERAPEUTICS COMMITTEE
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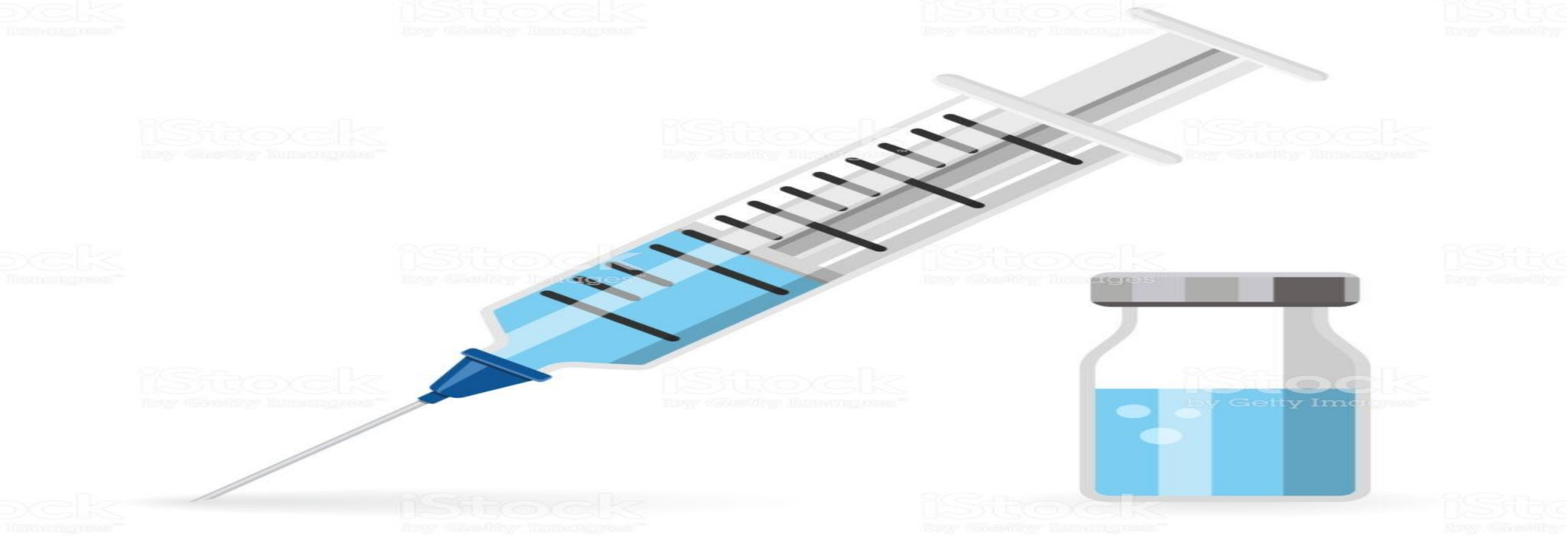

STANDARD INTRAVENOUS DRUG CONCENTRATION FOR INTENSIVE CARE UNIT & EMERGENCY ROOM RESUSCITATION

KINGDOM OF SAUDI ARABIA
MINISTRY OF HEALTH
SAMTAH GENERAL HOSPITAL
PHARMACEUTICAL CARE DEPARTMENT

INJECTION DOPAMINE PROTOCOL

PREPARATION: 1600mg injection Dopamine in 500ml Normal Saline
Formula: Order Dose (mg) x Body weight x Diluent x 60 min
Adding Medication (mg) x 1000
Dose: 2.5 – 20mcg/kg/min

ORDER DOSE	BODY WEIGHT																	
	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130
2.5	2.1	2.3	2.5	2.8	3	3.2	3.5	3.7	3.9	4.2	4.4	4.6	4.9	5.1	5.3	5.6	5.8	6
5	4.2	4.6	5	5.6	6	6.5	7	7.5	7.9	8.4	8.9	9.3	9.8	10.3	10.7	11.2	11.7	12.1
6	5	5.6	6.1	6.7	7.3	7.8	8.4	9	9.5	10.1	10.6	11.2	11.8	12.3	12.9	13.5	14	14.6
7	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.5	11.1	11.8	12.4	13.1	13.7	14.4	15	15.7	16.4	17
8	6.7	7.5	8.2	9	9.7	10.5	11.2	12	12.7	13.5	14.2	15	15.7	16.5	17.2	18	18.7	19.5
9	7.5	8.4	9.2	10.1	10.9	11.8	12.6	13.5	14.3	15.1	16	16.8	17.7	18.5	19.4	20.2	21	21.9
10	8.4	9.3	10.3	11.2	12.1	13.1	14	15	15.9	16.8	17.8	18.7	19.6	20.6	21.5	22.5	23.4	24.3
12	10.1	11.2	12.3	13.5	14.6	15.7	16.8	18	19.1	20.2	21.3	22.5	23.6	24.7	25.8	27	28.1	29.2
14	11.8	13.1	14.4	15.7	17	18.3	19.6	21	22.3	23.6	24.9	26.2	27.5	28.8	30.1	31.5	32.8	34.1
16	13.5	15	16.5	18	19.5	21	22.5	24	25.5	27	28.5	30	31.5	33	34.5	36	37.5	39
18	15.1	16.8	18.5	20.2	21.9	23.6	25.3	27	28.6	30.3	32	33.7	35.4	37.1	38.8	40.5	42.1	43.8
20	16.8	18.7	20.6	22.5	24.3	26.2	28.1	30	31.8	33.7	35.6	37.5	39.3	41.2	43.1	45	46.8	48.7

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REFERENCE: REFERENCE: Wellington ICU Drug Manual third edition 2020 https://drug.wellingtonicu.com/PDF/WellingtonICUDrugManual.pdf

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PHARMACEUTICAL CARE DEPARTMENT

INJECTION DOPAMINE PROTOCOL

Indications:
Treatment of hemodynamic imbalances present in shock due to MI, trauma, endotoxic septicemia, open heart surgery, renal failure and chronic cardiac decompensation as in refractory congestive failure.

Preparation: 1600mg Injection Dopamine in 500ml Normal Saline
Formula:

$$\frac{\text{Order Dose (mg)} \times \text{Body weight} \times \text{Diluent} \times 60 \text{ min.}}{\text{Adding Medication (mg)} \times 1000}$$

Dose: 2.5 – 20mcg/kg/min
Precautions:
1. Correct hypovolemia with either whole blood or plasma prior to treatment with dopamine.
2. Prefer large veins of the antecubital fossa to veins in the dorsum of the hand or ankle.
3. Gradually decrease the dose of dopamine while considering expansion with I.V. fluids and discontinuing therapy with this drug.
4. Closely monitor the following indices- urine flow, cardiac output and blood pressure during dopamine hydrochloride infusion as in the case of any adrenergic agent.
5. Closely monitor changes in fluid balance, electrolyte concentrations and acid base balance during prolonged parenteral therapy or whenever the condition of the patient warrants such evaluation.
6. The intravenous administration of solutions may cause fluid overloading resulting in dilution of serum electrolyte concentrations, over-hydration, congested states or pulmonary edema.

Caution: Use cautiously in Hypersensitivity to sulfites, Diabetic endarteritis, Occlusive vascular disease, Raynaud phenomenon, Ventricular arrhythmias, Decreased blood pressure, Hypotension.

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KINGDOM OF SAUDI ARABIA
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INJECTION DOBUTAMINE PROTOCOL

PREPARATION: 1000mg injection Dobutamine in 500ml Normal Saline
Formula: $\frac{\text{Order Dose (mg) x Body Weight x Diluent x 60 min.}}{\text{Adding Medication (mg) x 1000}}$
Initial Dose: 2.5 – 20mck/kg/min
Maximum Dose: 40mcg/kg/min

ORDER DOSE	BODY WEIGHT																	
	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130
2.5	3.3	3.7	4.1	4.5	4.8	5.2	5.6	6	6.3	6.7	7.1	7.5	7.8	8.2	8.6	9	9.3	9.7
5	6.7	7.5	8.2	9	9.7	11	11.2	12	12.7	13.5	14.2	15	15.7	16.5	17	18	18.7	20
10	13.5	15	16.5	18	19.5	21	22.5	24	25.5	27	28.5	30	31.5	33	35	36	37.5	39
15	20.2	22.5	24.7	27	29.2	32	33.7	36	38.2	40.5	42.7	45	47.2	49.5	52	54	56.2	59
20	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78
25	33.7	37.5	41.2	45	48.7	53	56.2	60	63.7	67.5	71.2	75	78.7	82.5	86	90	93.7	98
30	40.5	45	49.5	54	58.5	63	67.5	72	76.5	81	85.5	90	94.5	99	103	108	112	117
35	47.2	52.5	57.7	63	68.2	74	78.7	84	89.2	94.5	99.7	105	110	115	120	126	131	136
40	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156

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PHARMACEUTICAL CARE DEPARTMENT

INJECTION DOBUTAMINE PROTOCOL

Indications

Short- term treatment of cardiac decompensation due to depressed contractility form organic heart disease or from cardiac surgical procedures.

Preparation: 1000mg Injection Dobutamine in 500ml Normal Saline

Formula:

$$\frac{\text{Order Dose (mg) x Body weight x Diluent x 60 min.}}{\text{Adding Medication (mg) x 1000}}$$

Initial Dose: 2.5 – 20mcg/kg/min

Maximum Dose: 40mcg/kg/min

Precautions:

1. Before administrating dobutamine, hypovolumia should be corrected.
2. Can increase in heart rate or blood pressure, especially systolic pressure. Patients with pre-existing hypertension are at higher risk.
3. Patients with atrial fibrillation are at risk of developing rapid ventricular response.
4. Dobutamine may precipitate or exacerbate ventricular ectopic activity, but rarely causes ventricular tachycardia.
5. Monitor changes in fluid balance, electrolyte concentrations and acid-base balance during prolonged parenteral therapy.
6. Dobutamine solution in 5% dextrose should be used cautiously in patients with known diabetes mellitus.

Caution: Use cautiously in Atrial Fibrillation, Hypertension, Diabetes Mellitus, Hypovolemia, Asthma, Recent Myocardial Infarction, Ventricular Ectopic Activity.

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KINGDOM OF SAUDI ARABIA
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INJECTION LABETALOL PROTOCOL

PREPARATION: 300mg Inj. Labetalol in 500ml Normal Saline
Formula: $\frac{\text{Order Dose (mg) x body weight x 500ml x 60 min}}{\text{Adding Dose (300mg) x 1000}}$
Initial Dose: 0.4 – 1mg/kg/hour
Maximum Dose: 3mg/kg/hour

ORDER DOSE \ BODY WEIGHT	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130
0.4	1.8	2	2.2	2.4	2.6	2.8	3	3.2	3.4	3.6	3.8	4	4.2	4.4	4.6	4.8	5	5.2
0.5	2.2	2.5	2.7	3	3.2	3.5	3.7	4	4.2	4.5	4.7	5	5.2	5.5	5.7	6	6.2	6.5
0.6	2.7	3	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6	6.3	6.6	6.9	7.2	7.5	7.8
0.7	3.1	3.5	3.8	4.2	4.5	4.9	5.2	5.6	5.9	6.3	6.6	7	7.3	7.7	8	8.4	8.7	9.1
0.8	3.6	4	4.4	4.8	5.2	5.6	6	6.4	6.8	7.2	7.6	8	8.4	8.8	9.2	9.6	10	10
0.9	4	4.5	4.9	5.4	5.8	6.3	6.7	7.2	7.6	8.1	8.5	9	9.4	9.9	10	11	11.2	12
1	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	12	12	12.5	13
1.5	6.7	7.5	8.2	9	9.7	11	11.2	12	12.7	13.5	14.2	15	15.7	16.5	17	18	18.7	20
2	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
2.5	11.2	12.5	13.7	15	16.2	18	18.7	20	21.2	22.5	23.7	25	26.2	27.5	29	30	31.2	33
3	13.5	15	16.5	18	19.5	21	22.5	24	25.5	27	28.5	30	31.5	33	35	36	37.5	39

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PHARMACEUTICAL CARE DEPARTMENT

INJECTION LABETALOL PROTOCOL

Indication: Severe Hypertension
Preparations:

BOLUS: 20mg Inj. Labetalol in 80ml Normal Saline over 2 minutes.
May repeat 40 – 80mg every 10 minutes.
Maximum Total IV dose 300mg.

INFUSION: 300mg Inj. Labetalol in 500ml Normal Saline
Formula:

$$\frac{\text{Order Dose (mg)} \times \text{body weight} \times 500\text{ml} \times 60\text{ min.}}{\text{Adding Dose (300mg)} \times 1000}$$

Initial Dose: 0.4 – 1mg/kg/hour
Maximum Dose: 3mg/kg/hour

Precautions:

1. Therapy may cause depressed myocardial contractility and precipitation of more severe cardiac failure. Avoid use in CHF patients.
2. Abrupt cessation of therapy may cause exacerbations of angina pectoris and myocardial infarction in patients with coronary artery disease.
3. Adjust the dose of anti-diabetic drugs as therapy reduces the release of insulin in response to hyperglycemia.
4. Caution must be observed when reducing severely elevated blood pressure.
5. Monitor BP every 5 minutes.

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INJECTION ATRACURIUM PROTOCOL

1. As an adjunct to general anesthesia, to facilitate endotracheal intubation.
2. To provide skeletal muscle relaxation during surgery or mechanical ventilation.

Preparation: NO DILUTION
Formula:

$$\frac{\text{Order Dose (mcg) x body weight x 50ml x 60 min.}}{\text{Amount of Medication (mcg) x 1000}}$$

Bolus: 0.4 – 0.5mg/kg
Infusion:
Intermittent: 0.08 – 0.1 mcg/kg/min
Continuous: 2 – 15 mcg/kg/min

Precautions:

1. NOT for IM administration.
2. Use only under supervision of skilled in airway management and respiratory support.
3. Bradycardia during anesthesia may be more common with atracurium than with other muscle relaxants.

Cautions: Use cautiously in Renal impairment, Significant hepatic impairment, Myasthenia gravis, Cardiovascular disease, Dehydration or electrolyte abnormalities, Histamine sensitivity, Fractures or muscle spasm, Elderly patients, Hyperthermia, Extensive burns and shock, Low plasma pseudochlonisterase levels and Obese patient

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REFERENCE: Continuous Infusion Neuromuscular Blocking Agents-Clinical Practice Guideline. University of Wisconsin Hospital. June 2017

INJECTION AMIODARONE PROTOCOL

Indications:

1. Treatment and prophylaxis of frequently recurring ventricular fibrillation refractory to other therapy.
2. Hemodynamically unstable ventricular tachycardia refractory to other therapy.
3. Note: IV therapy can be used to treat patients with VT/VF who are unable to take oral amiodarone.

Preparation: 900mg Inj. Amiodarone in 500ml D5W
Formula:

$$\frac{\text{Order Dose (mg)} \times \text{Diluent} \times 60 \text{ min.}}{\text{Amount of Medication (mg)}}$$

Loading Dose: 5mg/kg or 150 – 300mg IV
Maintenance: 1mg/min for 6 hours followed by 0.5mg/min for 18 hours.
Total 24 hours infusion 1200mg.
1mg = 33.3ml/hr
0.5mg = 16.6ml/hr

Precautions:
1. Hypotension is the most the most common adverse event of IV amiodarone therapy, which may be treated by slowing the infusion or with vasopressors/positive inotropic agents, and volume expansion.
2. Risk of bradycardia and A-V block. Bradycardia may be treated by slowing infusion rate or discontinuing therapy.
3. Monitor LFT's. BP ECG, electrolytes at baseline and periodically thereafter.

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REFERENCE: MOH Pocket Manual in Critical Care https://www.moh.gov.sa/Documents/MOH%20Pocket%20Manual%20in%20Critical%20Care.pdf

DIABETIC KETOACIDOSIS PROTOCOL

INTRAVENOUS FLUID MANAGEMENT

1. If GRBS > 250mg/dl, IVF NORMAL SALINE 250 ml/hour
2. If GRBS < 250mg/dl, IVF change to D_5NS 250 ml/hour
3. If GRBS < 140mg/dl, IVF change to $D_{10\%}$ 250ml/hour

INJECTION REGULAR INSULIN INFUSION

GRBS PER mmol (mg/dl)	REGULAR INSULIN UNITS/HOUR
< 6 mmol (< 108mg/dl)	NO Insulin Infusion
6.1–9 mmol (109.8 – 162mg/dl)	2 units/hour
9.1–12 mmol (163.8-216mg/dl)	4 units/hour
12.1–15mmol (217.8-270mg/dl)	6 units/hour
15.1–18mmol (271.8-324mg/dl)	8 units/hour
18.1–21mmol (325.8-378mg/dl)	10 units/hour
> 22 mmol (>396mg/dl)	12 units/hour

REFERENCE: Guidelines and Protocols of Diabetic Emergencies https://www.moh.gov.sa/Documents/Diabetes-Emergencies.pdf

INJECTION POTASSIUM CHLORIDE INFUSION

SERUM POTASSIUM LEVEL	KCL/1L IVF
>5.5 mmol/L	NO KCL to be added in IVF. To Repeat Serum Electrolytes

	after 1 hour.
4.5 mmol/L – 5.5 mmol/L	**20 mEq/L**
3.5 mmol/L – 4.5 mmol/L	**30 mEq/L**
<3.5 mmol/L	**40 mEq/L + IVF 500 ml (Per CVL)** **40 mEq/L (Per Peripheral Line: IVF 500ml to add 20 mEq KCL @ 250ml/hour)** *** STOP Regular Insulin Infusion.** *** REPEAT Serum Electrolytes after 1 hour.** ***Regulate properly the Infusion Pump (Total Volume and Infusion Volume to infuse correct amount of fluid per hour).**

*CHECK BLOOD SUGAR HOURLY
*CHECK ABG, SERUM ELECTROLYTES EVERY 4 HOURS

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REFERENCE: Guidelines and Protocols of Diabetic Emergencies https://www.moh.gov.sa/Documents/Diabetes-Emergencies.pdf

INJ. ROCURONIUM (ESMERON) PROTOCOL

Indications:

Adjuncts to general anesthesia to facilitate both rapid sequence and routine tracheal intubation, and to provide skeletal muscle relaxation during surgery or mechanical ventilation.

Preparation: 10 ampules NO DILUTION

Formula: $\frac{\text{Order Dose (mcg) x body weight x volume (ml) x 60 (min)}}{\text{Drug concentration x 1000}}$

Bolus: 0.45mcg/kg Intravenous
Infusion: 4 – 16mcg/kg/min

Precautions:

1. Rocuronium Should be administered in carefully adjusted dosages by or under the supervison of experienced clinicians who are well trained in its use and where facilities for intubation, mechanical ventilation, oxygenation therapy and reversal agents are immediately available.
2. Rocuronium administration must be accompanied by adequate anesthesia or sedation.
3. Tolerance may developed during chronic administration in the intensive care unit.

Cautions: Use cautiously in Hepatic impairement, Pulmonary hypertension, Valvular heart disease, Pulmonary disease, Dehydration, Severe hypothermia.

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REFERENCE: Continuous Infusion Neuromuscular Blocking Agents-Clinical Practice Guideline. University of Wisconsin Hospital. June 2017

INJECTION ESMOLOL PROTOCOL

Indications:
1. Supraventricular Tachycardia.
2. Intraoperative and postoperatrive tachycardia and/ or hypertension.

Preparation: 2.5 gram Inj. Esmolol in 240ml Normal Saline
Formula:

$$\frac{\text{Order Dose (mcg)} \times \text{Body Weight}}{\text{Amount of Medication (mg)} \times 1000} \times \text{Dilution (ml)} \times 60 \text{ min.}$$

Loading Dose: 250 - 500mcg/kg over 1 minute IV
Infusion Dose: 50 – 100mcg/kg/min
Maximum Dose: 200 – 300mcg/kg/minute
If Desired Response NOT achieved: Repeat Loading Dose and increase IV infusion every 5 minutes to maximum dose.

Precautions:

1. Carefully monitor heart rate and blood pressure during administration.
2. Do not use for treatment of hypertension in patients in whom the increased blood pressure is primarily due to the vasoconstriction associated with hypothermia.

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REFERENCE: MOH Pocket Manual in Critical Care https://www.moh.gov.sa/Documents/MOH%20Pocket%20Manual%20in%20Critical%20Care.pdf

INJECTION FENTANYL PROTOCOL

Indications:
1. For analgesia action of short duration during the anesthetic periods, premedication, induction and maintenance and in the immediate postoperative period.
2. For use as a narcotic analgesic supplement in general or regional anesthesia.
3. For use as anesthetic agent with oxygen in selected high risk patients.

Preparation:

Single Strength: 500mg (10ml) Inj. Fentanyl in 40ml Normal Saline (100mg = 10ml)
Double Strength: 1000mg(20ml)Inj. Fentanyl in 30ml Normal Saline (100mg = 5ml)
Formula:

$$\frac{\text{Order Dose (mcg)} \times 50\text{ml}}{\text{Adding Dose in mcg}}$$

Bolus: 50 – 150mcg Intravenous
Infusion: 50 – 150mcg/hour

Precautions:

1. Therapy may produce bradycardia. Use with caution in patients with cardiac bradyarrhythmias.
2. Use with caution in patients with evidence of increased intracranial pressure, impaired consciousness, or coma, brain tumors.
3. Slowly taper to discontinue if at risk for physical dependence. Abrupt cessation can cause a withdrawal syndrome or precipitate seizures.

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REFERENCE: ICU Sedation Guidelines of Care San Diego Patient Safety Council. July 2010

INJ. MAGNESIUM SULFATE PROTOCOL

Indications:

1. Replacement therapy in magnesium deficiency, especially in acute hypomagnesemia.
2. Indicated as an intravenous anticonvulsant for the prevention and control of life- threatening convulsions in the treatment of severe pre-eclampsia and eclampsia of pregnancy.
3. Adjunct with total parenteral nutrition to correct or prevent hypomagnesemia.

Severe Deficit < 0.5 mmol/L:
Preparation and Infusion Rate: 50mEq diluted in 2000ml D5W over 21 hour then 50mEq/day for 3 days.
1000ml D5W over 3 hours then 80mEq diluted in

If Ventricular Tachycardia and Convulsions:
Preparation and Infusion Rate: 15- 30mEq diluted in 100ml D5W over 10-15 minutes then continue with previous regimen.
Formula:

$$\frac{\text{Order Dose x Diluent}}{\text{Hour(s)}}$$

Precautions:
1. Administration of magnesium sulfate beyond 5 to 7 days to pregnant women may cause adverse outcomes in fetus such as hypocalcemia and bone abnormalities.
2. Reserve IV use in eclampsia for immediate control of life- threatening convulsions.
3. Use with caution if flushing or sweating occurs.
4. Maintain urine output at a level of 100ml or more during the 4hours preceding each dose.
5. It is recommended to monitor serum magnesium levels and the patient's clinical status to avoid the consequences of over dosage in toxemia.
6. Evaluate knee jerk reflex before each dose when repeated doses are given parenterally; if they are absent, no additional magnesium intoxication in eclampsia.

Cautions: Use cautiously in: Renal Impairment, Nursing Mother.

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REFERENCE: Wellington ICU Drug Manual third edition 2020 https://drug.wellingtonicu.com/PDF/WellingtonICUDrugManual.pdf

INJECTION MIDAZOLAM PROTOCOL

Indications:

1. For sedation of intubated and mechanically ventilated patients as a component of anesthesia or during treatment in critical care setting.
2. For induction of general anesthesia, before administration of other anesthetic agents.

Preparation: 45mg Injection Midazolam in 36ml Normal Saline

Acute treatment: 0.1 – 0.2mg/kg loading dose

Sedation of intubated and mechanically ventilated patients:

Loading Dose: 0.05 – 0.2mg/kg
Maintenance Dose: 0.02 – 0.1mg/kg/hour
Formula:

$$\frac{\text{Order Dose (mg) x 45ml X 60 minute}}{\text{Adding Dose (mg)}}$$

Precautions:

1. Titrate slowly in adult or pediatric patients when used for sedation/ axiolysis/ amnesia.
2. Do not use therapy without individualization of dosage particularly when used with other medications capable of producing central nervous system depression.
3. Do not administer therapy to patients in shock or coma, or in acute alcohol intoxication with depression of vital signs.
4. After the discontinuation of therapy withdrawal symptoms of the barbiturate type may occur.

Caution: Use cautiously in Renal Impairment, Hepatic Impairment, Pulmonary Impairment, Elderly Patient, Sleep Apnea, CHF, CNS Depression, Alcohol use, alcohol or drug abuse history, Avoid abrupt withdrawal, Hx of Seizures.

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REFERENCE: Continuous Infusion Neuromuscular Blocking Agents-Clinical Practice Guideline. University of Wisconsin Hospital. June 2017

INJECTION FUROSEMIDE PROTOCOL

Indications:
1. Edema associated with CHF, liver cirrhosis, renal disease including nephrotic syndrome.
2. Mild to moderate hypertension (alone) and severe hypertension (combination agents).

Preparation: 2 ampules Inj. Lasix = 50ml (500mg) NO DILUTION (Sensitive to Light)
Formula:

$$\frac{\text{Desired dose x Quantity}}{\text{Drug Concentration}}$$

Infusion: Edema: 0.1 – o.4mg/kg/hour
Acute Pulmonary Edema: 1mg/kg
Hypercalcemia: 80-100mg IV/IM
Reduction of ICP: 0.5mg/kg IV

BOLUS
every 1 -2 hours

Precautions:
1. Furosemide is a potent diuretic. Intense diereses may cause dehydration and blood volume reduction with circulatory collapse and possibly vascular thrombosis and embolism. Hypokalemia may develop, especially with brisk dieresis, inadequate electrolyte intake, in presence of cirrhosis, prolonged use of laxatives, concomitant use of corticosteroids and ACTH. Observe patients for signs and symtomps of fluid and electrolyte imbalance.
2. Monitor for possible occurrence of blood dyscrasias and liver damage.
3. Monitor urine and blood glucose if diabetes or suspected latent diabetes.
4. Monitor serum electrolyte, magnesium, calcium, CO2, uric acid, and BUN/serum creatinine at baseline and periodically thereafter during active furosemide.

Cautions: Use cautiously in Hepatic impairment, Severe renal impairment, Acute MI, Gestational hypertension, Diabetes mellitus, Arrhythmias, SLE, Hearing impairment, Concurrent ototoxic agents, Hx of pancreatitis, Hx of gout, and Elderly patients.

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REFERENCE: Prescriber's Digital Reference Drug Information Furosemide Injection

INJECTION NITROGLYCERIN PROTOCOL

Indications:

1. Perioperative hypertension
2. Heart Failure in the setting of acute myocardial infarction.
3. Angina pectoris (not responding to sublingual nitroglycerine and beta-blockers).
4. Induction of intraoperative hypotension.

Preparation: 50mg Inj. Nitroglycerine in 500ml D5W

Formula:

$$\frac{\text{Order Dose (mg)} \times \text{Diluent} \times 60 \text{ min.}}{\text{Amount of Medication (mg)} \times 1000}$$

Infusion:

Initial Dose: 5mcg/minute
Maximum Dose: 20 mcg/minute
May increase every 3 – 5 minutes PRN by 5mcg/minute up to maximum dose.

Precautions:

1. Follow dosing instructions with utmost care. Use appropriate infusion sets as actual dose of nitroglycerine will be delivered.
2. Severe Hypotension with paradoxical bradycardia, increased angina pectoris and shock have occurred even with low doses, administer drug cautiously in patients who are volume depleted or are already hypotensive.
3. Continuously monitor blood pressure, heart rate in all patients and other measurements such as pulmonary, capillary wedge pressure to achieve the correct dose.

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REFERENCE: Wellington ICU Drug Manual third edition 2020 https://drug.wellingtonicu.com/PDF/WellingtonICUDrugManual.pdf

INJECTION NOREPINEPHRINE PROTOCOL

Indications:

1. Blood pressure control in certain acute hypotensive states.
2. As an adjunct in the treatment of cardiac arrest and profound hypotension.

Preparation: 16mg (16ml) Inj. Nor-adrenaline in 34ml D5W
Formula:

$$\frac{\text{Order Dose (mcg) x body weight}}{\text{Adding Dose (mg)}} \times \frac{\text{x 50ml x 60 min.}}{1000}$$

Infusion: 0.01 – 2mcg/kg/min

Precautions:

1. Closely monitor blood pressure every two minutes from the time administration is starred until the desired blood pressure is obtained, then every five minutes if administration is to be continued.
2. Constantly watch the rate of flow; patient should never be left unattended while receiving norepinephrine.
3. Administer therapy into large vein, particularly an antecubital vein because it decreases the risk of necrosis of the overlying skin from prolonged vasoconstriction.
4. The infusion site should be checked frequently for free flow, care should be taken to avoid extravasation into the tissues.

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INJECTION OMEPRAZOLE PROTOCOL

Indications:

Short-term treatment of active benign gastric ulcer, Prophylaxis of stress ulcer, Active duodenal ulcer, Erosive esophagitis (EE), Symptomatic GERD, Maintenace of healing of EE, Pathological hypersecretory conditions.

Preparation: 2 vials Inj. Omeprazole in 40 ml NSS/ D5W
Diluted in NSS - 8 hours in Room Temperature

Diluted in D5W – 6 hours in Room Temperature

Formula:

$$\frac{\text{Desired dose x Quantity}}{\text{Drug concentration}}$$

Initial Dose: Start 80mg bolus
Maintenance Dose: 8mg/hour x 72 hours

Precautions:

1. Avoid concomitant use of omeprazole with clopidogrel.
2. ALERT: Prolonged use of pump inhibitors may cause low magnesium levels. Monitor magnesium levels before starting treatment and periodically.
3. Monitor patients for sign and symptoms of low magnesium level, such as abnormal heart rate or rhythm, palpitations, muscle spasm, tremors or seizures.

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INJ. POTASSIUM CHLORIDE PROTOCOL

Indication: Treatment of potassium deficiency.
Preparations: If Potassium Level < 2.3mmol:
PERIPHERAL LINE: 80mEq/ 1L
CENTRAL LINE: 120mEq/ 1L
Infusion Rate:
Initial dose: 20 – 40mEq/ hour
Maximum dose: 60mEq/ hour

If RENAL IMPAIREMENT to administer 50% of doses.

Formula:

Order Dose x Diluent
60 (min.)

Precautions:

1. Infuse these solutions SLOWLY to avoid potassium intoxication.
2. Perform electrocardiogram and monitor serum electrolytes, acid base balance and the clinical status of the patient during therapy.
3. Monitor cardiac functions while using solutions containing potassium in presence of cardiac disease and renal disease.
4. On occurrence of adverse reactions immediately discontinue the infusion, evaluate the patient, provide appropriate therapeutic countermeasure and save the remainder of the fluid for examination if necessary.

Cautions: Use cautiously in Renal Impairment, Cardiovascular disease, Subclinical Diabetes Mellitus, Carbohydrate Intolerance, Diabetic Acidosis, Diabetic Gastroparesis, Acute dehydration, Extensive tissue breakdown as in severe burns, Adrenal Insufficiency, Systemic Acidosis, Dehydration, Extensive tissue breakdown, Concomitant use with potassium- sparing diuretic and Concomitant use with anticholinergic agents.

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INJECTION PROPOFOL PROTOCOL

Indications:

1. Intensive Care Unit (ICU) sedation of intubated, mechanically ventilated patients (Adults only).
2. Combined sedation and regional anesthesia *(Adults only).*

Preparation: NO Dilution

Formula:

Order Dose (mcg) x body weight x 50ml x 60 min.
Amount of Medication (mg) x 1000

Bolus: 1 – 1.5mcg/kg Intravenous
Infusion: Initially 5 mcg/kg/min
Increase 5 – 10mcg/kg/min every 10 minutes
Maintenance 25 – 100mcg/kg/minute

Precautions:

1. Closely monitor patients for early signs of hypotension, bradycardia, apnea, airway obstruction and/ or oxygen desaturation.
2. Do not co-administer with the same IV catheter as blood or plasma as compatibility is unknown.
3. Therapy is associated with Infusion Syndrome, which may result in death.
4. Abrupt withdrawal of drug may result in rapid awakening, associated anxiety, agitation and resistance to mechanical ventilation.
5. This infusion SHOULD be STOPPED after 48 hours because of infusion syndrome (usually dose >4mg/kg/hour): Acute Refractory Bradycardia, Rhabdomyolysis, Hyperlipidemia, Hepatomegaly, Heart Failure, and Acute Renal Failure.

Cautions: Use cautiously in Sepsis, ASA- PS III-IV, Elderly or debilitated patients, Hypertriglycerimia, Pancreatitis, Burns, Increase ICP, Impaired cerebral circulation, recent fluid shifts, hemodynamically unstable seizure disorder, diarrhea, and hyperkinemia.

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REFERENCE: REFERENCE: Continuous Infusion Neuromuscular Blocking Agents-Clinical Practice Guideline. University of Wisconsin Hospital. June 2017

INJ. SANDOSTATIN PROTOCOL

Indications:

1. Acromegaly patients who have had inadequate response to or cannot be treated with surgical resection, pituitary eradication, and bromocriptine mesylate at maximally tolerated doses.
2. Symptomatic treatment of patients with metastatic carcinoid tumors.
3. Treatment of the profuse watery diarrhea associated with vasoactive intestinal peptide tumors.

Preparation: 5 ampules Inj. Sandostatin in 500ml Dextrose 5%
Formula: Desired Dose x Quantity

INTEMITTENT DOSE: 50 – 100mcg SQ every 8 hours
ESOPHAGEAL VARICE: 50mcg IV Bolus then 25 -50mcg/hour for 1 – 5 days
G.I. BLEEDING or PANCREATIC ULCERS: 50 – 200mcg SQ every 8 hours for 1 – 12 days
ILIOSTOMY-RELATED DIARRHEA: 25mcg/hour or 50mcg SQ every 12 hourly

Precautions:

1. Monitor the patient periodically. Drug may alter fluid and electrolytes balance.
2. Insulin requirements may be decreased with risk of hypoglycemia, monitoring is highly recommended. Adjust anti-diabetic treatment accordingly.
3. Perform thyroid function test at the baseline and periodically during chronic octreotide therapy. Octreotide can cause hypothyroidism as it suppress the secretion of thyroid-stimulating hormone.

Cautions: Use Cautiously in Hepatic impairment, Renal impairment, Diabetes mellitus, History of cardiac disease, Thyroid Diseases and Biliary diseases.

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REFERENCE: MOH Pocket Manual in Critical Care https://www.moh.gov.sa/Documents/MOH%20Pocket%20Manual%20in%20Critical%20Care.pdf

INJ. SODIUM NITROPRUSSIDE PROTOCOL

Indications:

1. Immediate Reduction of blood pressure of patients in hypertensive crises.
2. Producing controlled hypotension in order to reduce bleeding during surgery.
3. Treatment of acute congestive heart failure.

Preparation: 100mg Inj. Sodium Nitroprusside in 46ml Normal Saline
Formula:

$$\frac{\text{Order Dose (mcg)} \times \text{Body Weight} \times \text{Dilution (ml)} \times 60 \text{ min.}}{\text{Amount of Medication (mg)} \times 1000}$$

Initial Dose: 0.3mcg/kg/min
Maintenance dose: 0.25 – 10mcg/kg/min

Precautions:

1. **NOTE:** the container and the section must be protected. PHOTOSENSITIVE.
2. Put patient into a head-down (Trendelenburg) position to maximize venous return on occurrence of hypotension. Avoid concomitant use in hypertensive patients, patients receiving other antihypertensive medications.
3. Monitor serum thiocyanate levels, acid-base balance, ABGs, blood pressure continuously and Creatinine at baseline.
4. Prolong infusions in patients have led to CYANIDE TOXICITY, death has occurred in patients receiving nitroprusside infusion at (30- 120mcg/kg/min).
5. Signs of cyanide toxicity are not present until an hour or more after the cyanide capacity of the body's red-cell mass has been exhausted.
6. Infusion Sodium Thiosulfate to overcome cyanide toxicity.

Cautions: Use cautiously in Renal Impairment, Hepatic Impairment, Hypotension, Cardiovascular disease, Angina Pectoris, Myocardial infarction, Ischemic damage, Ataxia, Seizures, Stroke, Increased intracranial pressure, Patient with poor surgical risk, Pulmonary disease, Anemia, Hypovolemia, Hyponatremia, Vitamin B12 deficiency, and Geriatrics.

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REFERENCE: MOH Pocket Manual in Critical Care https://www.moh.gov.sa/Documents/MOH%20Pocket%20Manual%20in%20Critical%20Care.pdf

INJ. SODIUM BICARBONATE PROTOCOL

Indications:

1. Treatment of Metabolic Acidosis associated with severe renal disease, uncontrolled diabetes circulatory insufficiency due to shock or severe dehydration, extracorporeal circulation of blood, cardiac arrest and severe primary lactic acidosis.
2. Treatment of certain drug intoxications including barbiturates, poisoning by salicylates or methyl alcohol.
3. Alkalization of the urine in hemolytic reactions.
4. Severe diarrhea accompanied by a significant loss of bicarbonate.

Preparation: NO DILUTION
Formula: $\frac{\text{Order Dose x body weight}}{\text{Drug Concentration}}$

Severe Metabolic Acidosis: 1mEq/kg BOLUS or HCO3 = BE x body weight x 0.3
Non-Life Threatening Metabolic Acidosis: Infusion: 2 – 5mEq / kg IV for 4 – 8 hours
Alkalinization of the urine: Methanol Poisoning: 0.25 – 1 mEq / kg slow bolus.
Repeated according to ABG result.

Precautions:

1. Use cautiously in patients with CHF, severe renal impairment and conditions involving edema with sodium retention, as it may cause sodium retention, over hydration, dilution of serum electrolytes, fluid overload, congestion and pulmonary edema.
2. Ensure that the solution is clear and the container/seal is intact before use.
3. Therapy may cause potassium depletion, predisposing patients to metabolic alkalosis. Appropriate correction of electrolyte imbalances before or during bicarbonate infusion can minimize such risks.
4. AVOID adding sodium bicarbonate to parenteral solutions containing calcium, except where compatibility has been previously established.

Cautions: Use cautiously in Hypocalcemia, Hypokalemia, Hypervolemia, Hypernatremia, Bartter Syndrome and Children <2 yrs.

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INJECTION VASOPRESSIN PROTOCOL

Indications:

Prevention and treatment of postoperative abdominal distension, facilitation of abdominal roentgenography, and diabetes insipidus.

Preparation: 20 units in 49ml Normal Saline
Formula:

$$\frac{\text{Order Dose (mcg)} \times 50\text{ml} \times 60\text{min.}}{\text{Adding Dose in mcg}}$$

Infusion: 0.01 unit/minute = 1.5m/hour
0.02 units/minute = 3ml/hour
0.03 units/minute = 4.5ml/hour
0.04 units/minute = 6ml/hour

Precautions:

1. Avoid vasopressin in patients with vascular disease, especially disease of the coronary arteries; in such patients, small doses may precipitate angina pain and with larger doses the possibility of myocardial infarction.
2. Therapy may produce water intoxication; signs of drowsiness, listlessness and headaches should be recognized to prevent terminal coma and convulsions.
3. Electrocardiograms (ECG), fluid, and electrolyte status evaluation is recommended at periodic intervals during therapy.

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INJECTION EPINEPHRINE PROTOCOL

Preparations:

HIGH CONCENTRATED: 20mcg/ml

- **1 ampule Inj. Epinephrine + 49 ml D5W or NS (1ml= 1mg = 1000mcg)**
- **5 ampules Inj. Epinephrine + 245 ml D5W or NS (1ml = 1mg = 1000mcg)**

LOW CONCENTRATED 20mcg/ml

❖ 5 ampules Inj. Epinephrine + 245 ml D5W or NS (1ml = 1mg = 1000mcg)

ADMINISTRATION TABLE OF EPINEPHRINE INFUSION								
mcg / min.	1	3	6	9	10	12	14	16
HIGH CONCENTRATED (ml / hr)	3	9	18	27	30	36	42	48
LOW CONCENTRATED (ml / hr)	15	45	90	135	150	180	210	240

Precautions:

1. **Store in light –resistant container. Discard after 24 hours or if solution is discolored or contains precipitate.**
2. **Do not administer auto injection IV; administer only in out thigh to ensure SC or IM administration.**
3. **Whenever possible, administer Epinephrine infusions into a large vein.**
4. **Correct blood volume depletion as fully as possible prior to administering any vasopressor.**

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IV INSULIN INFUSION PROTOCOL – NON-DIABETIC KETOACIDOSIS NON HYPEROSMOLAR HYPERGLYCEMIC STATE

GOAL : Blood Glucose 8 -10MMOL/L .
Standard drip : 1 unit of regular insulin per 1 ml of 0.9 % NS via an infusion device.

INTRAVENOUS FLUIDS:
Most patient will need 5 -10 grams of glucose per hours
D5W or D5W m0.45 N5 at 100 – 200 ml/hr or equivalent (TPN , enteral feeds, etc.)
For patients with fluid- restriction use D10W 50 ml/hr.
---algorithm (1) = starts here .
---algorithm (2) = use for patients not controlled with algorithm (1) , POST CABG, post solid organ transplant , Receiving glucocorticoids.

Patients with diabetes receiving more than 80 units / day of insulin as outpatients.

Algorithm (1)		Algorithm (2)	
Blood Glucose Mmol / L	Unit /hr	Blood Glucose Mmol	Unit /hr
Less than a mmol/L hold Insulin Infusion and manage as hypoglycemia (see below for treatment			
4-8	off	4.8	off
8-1-10	1	8-1-10	1.5
10-1-12	1.5	10-1-12	2
12-1-14	2	12-1-14	2.5
14-1-16	2.5	14-1-16	3
16-1-18	3	16-1-18	4
18-1-20	3.5	18-1-20	5
20-1-22	4	20-1-22	6
More than 22	5 + inform physician	More than 22	7 + inform physician

PATIENTS MONITORING :
check capillary blood glucose every hour until it is within goal range for 4 hours , then decrease to every 2 hours four times , and if remain stable may decrease every 4 hours .
Hourly monitoring maybe indicated for critically ill patients even if they have stable blood glucose .
TREATMENT OF HYPOGLYCEMIA (Blood glucose less than 4 mmol/L,
Discontinue Insulin drip . Give D50W IV

- **Patient Awake : 25 ml bolus**
- **Patient not Awake : 50 ml Bolus**

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REFERENCE : **Treatment of Electrolyte Disorders in Adult Patients in the ICU , American Society of Health , System Pharmacist , Vol. 62 August 15 , 2005**

ELECTROLYTE REPLACEMENT PROTOCOL FOR ADULT CRITICALLY ILL PATIENTS

ASSESTMENT :

Checked Serum Potassium , Magnesium , Phosphorous and creatinine level DAILY .
Examine ECG Monitor for Dysrhythmias.
Exclusions:

- **Patients on Dialysis (CVVHD)**

- Dysrhythmias - Seizures - Weight ≤ 45 kg - Diabetic Ketoacidosis
- Age ≤ 14 years - Cardiac Patients .

INTERVENTION :

- Call the Physician in presence of the exclusion criteria .
- Replacement must be done using an infusion pump under continue ECG monitoring
- Cal TPN Pharmacist if the patients is on TPN.
-

POTASSIUM REPLACEMENT

(A) Urine Output - ≥ 40 ml /hr and Serum Creatinine ≥ 115 umol/L

Serum Potassium	Peripheral I.V Replacement	Central I.V Replacement
3.4 – 3.7 mmol/L	30 mml KCl in 500ml N5 over 3 hours	30 mml KCl in 250ml N5 over 3 hours
2.6 – 3.3 mmol/L	40 mml KCl in 500ml N5 over 4 hours	40 mml KCl in 250ml N5 over 3 hours
≤2.5 mmol/L	40 mml KCl in 500ml NS & call Doctor	Call Intensivist

(B) Urine Output - ≥ 40 ml /hr and Serum Creatinine ≥ 115 umol/L for 2 hours before Replacement

Serum Potassium	Peripheral I.V Replacement	Central I.V Replacement
3.4 – 3.7 mmol/L	15 mml KCl in 500ml N5 over 3 hours	15 mml KCl in 250ml N5 over 3 hours
2.6 – 3.3 mmol/L	20 mml KCl in 500ml N5 over 4 hours	20 mml KCl in 250ml N5 over 3 hours
≤2.5 mmol/L	20 mml KCl in 500ml NS & call Doctor	Call Intensivist

MAGNESIUM REPLACEMENT

Serum Magnesium	Replacement
0.5-.0.75 mmol/L	20 mmol (5grams) Magnesium sulfate in 100ml NS over 2 hours .
≤ 0.5 mmol/L	Call Doctors

Serum Magnesium	Replacement
0.71 - 0.9 mmol/L	15 mmol Phosphate (as Sodium or Potassium Phosphate in 100 ml NS over 4 hours
0.5 – 0.7 mmol/L	20 mmol Phosphate (as Sodium or Potassium Phosphate in 100 ml NS over 4 hours
≤ 0.5 – mmol/L	30 mmol Phosphate (as Sodium or Potassium Phosphate in 100 ml NS over 4 hours

- Recheck Potassium level 2 hours post replacement , Magnesium and phosphorous level 24 hours post replacement .
- Document Replacement in the Medication Records .

- This guideline focuses on a uniq1ue need . It is not intended to replace sound medical judgment or clinical decision making .

- **Notify the Physician**
- **Recheck blood glucose every 30 minutes and repeat 25 ml of D50W if ≤ 4 mmol/L**

NOTIFY PHYSICIAN FOR :

- **Any difference between two consecutive reading of blood glucose more than 5.6 mmol/L , or urine and plasma ketone are positive**
- **Blood Glucose ≥ 22 mmol/L**

NOTES:

Patients not controlled with above algorithms need an endocrine consult.

For type 1 DM if blood glucose is ≥ 13mmol/L, do urine, blood ketone, and if positive, activate DKA protocol and consult the endocrinologist.

MOVING FROM ALGORITHM TO ALGORITHM:

Moving Right : If blood glucose outside the goal range or the blood glucose does not change by at least 3.3 mmol/L within 1 hour .

Moving Left : When blood glucose is less than 4 mmol/L two times or the blood glucose decrease by more than 5.5 mmol/L within 1 hour.

- **This guideline focuses on a unique need. It is not intended to replace sound medical judgment or clinical decision –making.**

REFERENCES:

1. **American Diabetes Association standards or Medical Care in Diabetes -2017**
2. **Intensive Versus Conventional Glucose Control in Critically ill Patients, The nice sugar study , New England Journal as Medicine , 2009.**

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Procainamide

- First-line agent for WCT (along with amiodarone) for treatment of hemodynamically stable WCT and WCT due to WPW syndrome.
- Alternative agent for hemodynamically unstable WCT and VF
- Dosing loading dose up to a total initial dose of 17 mg/kg followed be a maintenance infusion of 1 to 4 mg/minute

- Adverse effects

- Vasodilation and negative inotropy

- Avoid with depressed ventricular function (ejection fraction 40%) < in favor of amiodarone

- Avoid in patients with significant renal dysfunction.

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RREFERENCE: MOH Pocket Manual in Critical Care https://www.moh.gov.sa/Documents/MOH%20Pocket%20Manual%20in%20Critical%20Care.pdf

Lidocaine 1% pre-filled syringe

- Indication

- Acute management life-threatening ventricular arrhythmias, especially when associated with myocardial ischemia.

- Dosing: 1 to 1.5 mg/kg IV bolus. Can repeat to maximum bolus of 3mg /kg, followed by an infusion of 1 to 4mg /minute.

- Adverse effects: - Neurologic toxicity (seizures, tremors)

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REFERENCE: MOH Pocket Manual in Critical Care https://www.moh.gov.sa/Documents/MOH%20Pocket%20Manual%20in%20Critical%20Care.pdf

TIGHT

RBS SLIDING SCALE

RBS	SLIDING SCALE REGULAR INSULIN

< 5 mmol	**N / I**
5.1 – 8 mmol	**3 units**
8.1 – 10 mmol	**4 units**
10.1 – 12 mmol	**6 units**
12.1 – 14 mmol	**8 units**
14.1 – 16 mmol	**10 units**
16.1 – 18 mmol	**12 units**
18.1 – 20 mmol	**14 units**

Reference:

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REGULAR INSULIN SLIDING SCALE -STANDARD ORDERS

Recommended Indications:

- **As a supplement to a patient's usual diabetes medications (long-acting insulin or oral agents) to treat uncontrolled high blood sugars**
- **For short term use (24-48 hours) in a patient admitted with an unknown insulin requirement**

Regimens:

- **Low Dose Scale: Suggested starting point for thin and elderly, or those being initiated on TPN**
- **Moderate Dose Scale: Suggested starting point for average patient**
- **High Dose Scale: Suggested for patients with infections or those receiving therapy with high dose corticosteroids**

Blood Sugar (mg/dL)	Low Dose Scale	Moderate Dose Scale	High Dose Scale	Patient-Specific Scale
<70	Initiate Hypoglycemia Protocol	Initiate Hypoglycemia Protocol	Initiate Hypoglycemia Protocol	Initiate Hypoglycemia Protocol
70-130	0 units	0 units	0 units	____ units
131-180	2 units	4 units	8 units	____ units
181-240	4 units	8 units	12 units	____ units
241-300	6 units	10 units	16 units	____ units
301-350	8 units	12 units	20 units	____ units
351-400	10 units	16 units	24 units	____ units
>400	12 units and call MD	20 units and call MD	28 units and call MD	____ units and call MD

Check Blood Sugars:
AC and HS (6:30 AM, 11:30 AM, 4:30 PM and 9:30 PM)
BID (6:30 AM and 4:30 PM)
q 6 hours (recommended for patients receiving continuous nutrition over 24 hours)
q 4 hours (recommended for patients requiring close monitoring)

REFERENCE: ENDOCRINE PRACTICE VOL. 2 No: 2 March / April 2013

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