Drug Guideline Title: Sodium Bicarbonate

Summary: This guideline outlines the use of sodium bicarbonate, which is an alkalinising agent that is used in the management of severe metabolic acidosis and hyperkalemia.

Approved by: ICU Medical Director
Publication (Issue) Date: February 2014
Next Review Date: February 2017
Replaces Existing Drug Guideline: Sodium Bicarbonate
Previous Review Dates: 2002, 2004

1. Introduction contains:
The risk addressed by this policy:

Patient Safety

The Aims / Expected Outcome of this policy:

Sodium Bicarbonate will be administered safely and without adverse side effects

Related Standards or Legislation

NSQHS Standard 1 Governance

National Standard 4 Medication Safety

Related Policies

- LH_PD2013_C03.01 Drug Administration
- LH_PD2010_C03.00 Drug Prescribing
- LH_PD2008_C03.12 Administration of IV Medication

2. Policy Statement:

- All care provided within Liverpool Hospital will be in accordance with infection control, manual handling and minimisation and management of aggression guidelines.
- Medications are to be prescribed and signed by a medical officer/authorised nurse practitioner (NP) unless required during an emergency.
- All drugs administered during an emergency (under the direction of a medical officer/authorised nurse practitioner) are to be documented during the event, then prescribed and signed following the event.
- Medications are to be given at the time prescribed (as close to the time as is possible when multiple drugs require ‘same time’ administration and, when the nurse is caring for more than one patient, recognition is given to a possible short delay to
Sodium Bicarbonate administration – antibiotics and other lifesaving drugs are to be prioritised) and are to be signed by the administering nurse.

- Parenteral medication prescriptions and the drug are to be checked with a second registered or endorsed enrolled nurse prior to administration. The “rights of drug administration” must be followed: right: patient, drug, dose, route, administration, time, reason for the drug, documentation, education and evaluation/outcome.
- Adverse drug reactions are to be documented and reported to a medical officer.
- Medication errors are to be reported using the hospital electronic reporting system: IIMS.
- Guidelines are for adult patients unless otherwise stated.

3. Principles / Guidelines

**Actions**

Sodium bicarbonate is an alkalising agent, which combines with hydrogen ions to form a weak carbonic acid, which dissociates into carbon dioxide and water.

\[
\text{Carbon dioxide} + \text{Water} \rightarrow \text{Carbonic acid} \rightarrow \text{Hydrogen} + \text{Bicarbonate}
\]

(Lungs) \hspace{1cm} \hspace{1cm} \hspace{1cm} \hspace{1cm} (Kidneys)

\[
\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{H} + \text{HCO}_3^-
\]

- Therefore, sodium bicarbonate acts as a buffer in metabolic acidosis.
- During sodium bicarbonate administration, plasma hydrogen levels fall, causing further hydrogen ions to come out of the cells. To preserve electrical neutrality, potassium moves into the cells. Therefore, sodium bicarbonate can lower serum potassium.

*Note: Additional ventilatory support (hyperventilation) is required to remove the excess carbon dioxide generated during therapy.*

**Indications**

- May be considered in severe metabolic acidosis, with pH less than 6.90.
- Hyperkalaemia
- Alkalisng agent for the urine in rhabdomyolysis.
- Tricyclic antidepressant overdose- When QRS widening is progressive and associated with a decompenation in airways, breathing or circulation intravenous boluses of sodium bicarbonate and concurrent hyperventilation therapy (by intubation and mechanical ventilation) should be used to increase the pH to a target of 7.45 to 7.55
- Protracted cardiac arrest (greater than 15 mins). *In most cardiac arrests early efficient CPR and adequate ventilation negates the need for administering sodium bicarbonate.*

**Contraindications**

- Metabolic alkalosis.
- Hypokalaemia
- Hypocalcaemia

**Precautions**

- Arterial blood gases should be performed before and during the course of treatment to minimise the possibility of resultant alkalosis.
- Ensure adequate ventilation of the patient to get rid of excess carbon dioxide.
- Correct electrolyte imbalances such as hypokalemia and hypocalcemia prior to or concomitantly with administration of sodium bicarbonate therapy.

**Significant Interactions**

- Sodium bicarbonate and adrenaline or calcium when mixed together may inactivate each other, precipitate and block the IV line. Ensure that the IV line is well flushed between drugs, especially in an arrest situation when using the same access line.
- Corticosteroids and corticotrophins.
• Urinary alkalinisation will increase the renal clearance of tetracyclines, especially doxycycline

**Adverse Effects**
- Metabolic alkalosis
- Hyperosmolality, hypernatraemia, hypokalaemia.
- Intracellular acidosis may develop or worsen when the CO₂ liberated from NaHCO₃ freely enters the cells.
- Pulmonary oedema – sodium load of 50mmol is equivalent to 330mls of Normal Saline.
- Tissue necrosis or sloughing occurs with extravasation.

**Presentation**
Sodium Bicarbonate 8.4%, (84mg/mL) 50mmol in 50mL Minijet.
Sodium Bicarbonate 8.4%, (84mg/mL) 10mmol in 10mL glass single dose vial.

**Administration Guidelines**

**Cardiac Arrest**
- In protacted cardiac arrest (>15 minutes) - An initial dose of 1mmol/kg, given over 2-3 minutes, then as guided by arterial blood gases.

**Cardiac Arrest - Paediatric Dose**
- In the presence of severe metabolic acidosis (pH< 7.1) or prolonged arrest (>15 minutes), administer IV or IO dose of 0.5 -1.0mmol/kg. Administer after adequate ventilation with oxygen and chest compressions have been established.

**Hyperkalaemia**
- 50mmol slowly IV (over 5 -10 minutes) depending on the potassium level and severity of hyperkalaemia.
- This may be repeated until the T waves and QRS complexes return to normal.

**Rhabdomyolysis**
- 50mmol slowly IV, followed by an infusion at 10mmol/hr.
- Measure the urinary pH hourly, and increase the infusion until the urinary pH is > 6.5
  **Note:** The mainstays of treatment are detection and treatment of life-threatening hyperkalaemia, and ensuring early and generous intravenous fluids to maintain urine output at 1 to 2 mL/kg/hour.

**Tricyclic Antidepressant Overdose.**
- Sodium bicarbonate 8.4% (= 1 mmol/mL) 1 to 2 mmol/kg IV bolus, every 3 to 5 minutes, titrated to a narrowing of the QRS complex.

**Clinical Considerations**
- Avoid extravasation
- Monitor potassium, calcium and sodium levels.
- Monitor arterial blood gases.
- Ensure adequate ventilation and oxygenation of the patient.

4. **Performance Measures**
All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.
5. References and links

Author: CNC (S.Shunker),
Endorsed by: A/ Prof. Michael Parr, ICU Director