SODIUM BICARBONATE 8.4%

(SODIUM BICARBONATE) INJECTION

1 NAME OF THE MEDICINE

Sodium bicarbonate

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

8.4 g/100 mL (8.4%) Sodium Bicarbonate Injection contains 8.4 g sodium bicarbonate in 100 mL water for injections.

840 mg/10 mL (8.4%) Sodium Bicarbonate Injection contains 0.84 g sodium bicarbonate in 10 mL water for injections.

Sodium Bicarbonate Injection is a sterile solution. Each mL of solution contains 84.0 mg of sodium bicarbonate which gives 23.0 mg (or 1 mmol or 1 mEq) of sodium and 61.0 mg (or 1 mmol or 1 mEq) of bicarbonate.

For the full list of excipients, see Section 6.1 List of Excipients.

3 PHARMACEUTICAL FORM

Clear, colourless solution for injection.

4 CLINICAL PARTICULARS

4.1 THERAPEUTIC INDICATIONS

Sodium Bicarbonate Injection is indicated as an alkalinising agent in the treatment of metabolic acidosis which may occur in many conditions including diabetes, starvation, hepatitis, cardiac arrest, shock, severe dehydration, renal insufficiency, severe diarrhoea, Addison's disease or administration of acidifying salts (e.g. excessive sodium chloride, calcium chloride, ammonium chloride).

Sodium Bicarbonate Injection is also used to increase urinary pH in order to increase the solubility of certain weak acids (e.g. cystine, sulphonamides, uric acid) and in the treatment of certain intoxications (e.g. methanol, phenobarbitone, salicylates, lithium) to decrease renal absorption of the drug or to correct acidosis.

4.2 DOSE AND METHOD OF ADMINISTRATION

Dosage of Sodium Bicarbonate Injection is determined by the severity of the acidosis, appropriate laboratory determinations, and the patient's age, weight and clinical condition.

Sodium Bicarbonate Injection is administered by the intravenous route preferably via a central line. Extravasation must be avoided; the solution is hypertonic and irritant to veins resulting in extensive skin necrosis if the solution leaks from the vein in the tissues. Intramuscular injection is not recommended.

Contains no antimicrobial agent and is for single use in one patient on one occasion only.

Cardiac arrest or severe metabolic acidosis

Administration is based on the results of arterial blood pH, Pa_{CO2} and calculation of base deficit.

In cardiac arrest, an initial direct intravenous dose of 1 mmol/kg (1 mL/kg of an 8.4% sodium bicarbonate solution) may be given, followed by 0.5 mmol/kg (0.5 mL/kg of an 8.4% sodium bicarbonate solution) at ten minute intervals depending on arterial blood gases and according to the appropriate treatment protocol and guidelines.

Adequate alveolar ventilation should be ensured during cardiac arrest and administration of sodium bicarbonate, since adequate ventilation contributes to the correction of acidosis and since administration of sodium bicarbonate is followed by release of carbon dioxide.

Children

The usual dose is 1 mmol/kg (1 mL/kg of an 8.4% Sodium Bicarbonate Injection) given by slow intravenous injection.

Infants (up to 2 years of age)

In infants (up to 2 years of age) the solution should be diluted with an equal amount (1:1 ratio) of 5% glucose or water for injections (to make 4.2% sodium bicarbonate solution) for slow intravenous administration and at a dose not to exceed 8 mmol/kg/day, and according to the appropriate treatment protocol and guidelines. This diluted solution is hypertonic. Slow administration rates and a 4.2% solution are recommended in neonates to minimise the possibility of producing hypernatraemia, decreasing cerebrospinal fluid pressure and inducing intracranial haemorrhage. (See Section 4.4 Special Warnings and Precautions for Use and Section 4.8 Adverse Effects (Undesirable Effects)).

Sodium bicarbonate should only be given if the child is being effectively ventilated as any carbon dioxide that is released by the process of acid neutralisation must be removed from the body via the lungs or paradoxical intracellular acidosis will result.

Intravenous infusion

In less urgent forms of metabolic acidosis, Sodium Bicarbonate Injection may be added to 5% glucose for intravenous infusion. (See Section 4.5 Interactions with Other Medicines and Other Forms of Interactions).

Sodium Bicarbonate 8.4% Injection can be diluted with 5% glucose injection or 0.9% sodium chloride injection. To reduce microbiological hazard, use as soon as practicable after dilution. If storage is necessary, hold at 2°C-8°C for not more than 24 hours.

Sodium Bicarbonate Injection for intravenous infusion is preferably administered in a large vein, over 4 to 8 hours in mild conditions of metabolic acidosis.

The amount of bicarbonate to be given as intravenous infusion to older children and adults over a 4 to 8 hour period is approximately 2 to 5 mmol/kg of bodyweight, depending upon the severity of the acidosis as judged by the lowering of the total CO_2 content, blood pH and clinical condition of the patient. Standard texts and institutional protocols specific to the underlying disorder should be consulted for calculation of individual dosage.

Bicarbonate therapy should always be planned in a stepwise fashion since the degree of response from a given dose is not precisely predictable.

In general, it is unwise to attempt full correction of a low total CO_2 content during the first 24 hours of therapy, since this may be accompanied by an unrecognised alkalosis because of a delay in the readjustment of ventilation to normal.

4.3 CONTRAINDICATIONS

Sodium Bicarbonate Injection is contraindicated in patients with renal failure, respiratory or metabolic alkalosis, hypoventilation or chloride depletion, hypernatraemia, hypertension, oedema, congestive heart failure, eclampsia, aldosteronism, a history of urinary calculi and consistent potassium depletion or hypocalcaemia.

It is also generally contraindicated in patients with excessive chloride loss from vomiting or continuous gastrointestinal suctioning and in patients at risk of developing diuretic induced hypochloraemic alkalosis.

4.4 SPECIAL WARNINGS AND PRECAUTIONS FOR USE

Treatment strategies for metabolic acidosis are primarily directed towards the underlying cause. Bicarbonate therapy is a temporary measure used for severe acidosis.

Specialised texts and protocols should be consulted to guide use. Note that sodium bicarbonate 8.4% is a hypertonic solution.

Whenever respiratory acidosis is present with metabolic acidosis, both pulmonary ventilation and perfusion must be adequately supported to get rid of excess carbon dioxide.

Laboratory determination of the patient's acid base status is recommended before and during treatment to minimise the possibility of overdosage and resultant metabolic alkalosis. Frequent monitoring of serum electrolyte concentrations is essential.

To minimise the risks of pre-existing hypokalaemia and/or hypocalcaemia, these electrolyte disturbances should be corrected prior to initiation of, or concomitantly with, sodium bicarbonate therapy.

Solutions containing sodium may cause fluid overload when given in excess, resulting in dilution of serum electrolytes, overhydration, congestive conditions or pulmonary oedema.

Excessively elevated plasma sodium concentrations may cause dehydration of the brain, resulting in somnolence and confusion, which may progress to convulsions, coma, respiratory failure and ultimately death.

Bicarbonate should be given with caution to patients with ‘type A’ lactic acidosis (tissue hypoxia). Administration of bicarbonate will tend to limit the available oxygen, increase lactate production and thus worsen the acidosis.

Data from the literature are not in favour of the use of bicarbonate in the treatment of diabetic ketoacidosis with pH values between 6.90 and 7.10.

Accidental extravascular injection of hypertonic solutions may cause vascular irritation, chemical cellulitis (because of their alkalinity), subsequently resulting in tissue necrosis, ulceration and/or sloughing at the site of injection.

The use of scalp veins should be avoided.

Do not use the injection if it contains precipitate. Do not use unless the solution is clear and the container and seal are intact. Discard any unused portion.

Use in patients with congestive heart failure or renal insufficiency

Sodium retention and oedema may occur during sodium bicarbonate therapy, especially when the drug is given in large doses or to patients with renal insufficiency, congestive heart failure or those predisposed to sodium retention and oedema. Sodium and water overload may result in hypernatraemia and hyperosmolality. Severe hyperosmolal states may develop during cardiopulmonary resuscitation when excessive doses of sodium bicarbonate are administered. Serum potassium may decrease during sodium bicarbonate therapy leading to hypokalaemia.

Sodium bicarbonate should be used with extreme caution in patients with congestive heart failure or other oedematous or sodium-retaining conditions; in patients with renal insufficiency, especially those with severe insufficiency such as oliguria or anuria; and in patients receiving corticosteroids or corticotropin, since each gram of sodium bicarbonate contains 12 mEq of sodium.

Use in hepatic impairment

Sodium bicarbonate should be used with caution in patients with cirrhosis.

Use in renal impairment

Sodium bicarbonate should be used with extreme caution in patients with renal insufficiency, especially those with severe insufficiency such as oliguria or anuria; and in patients receiving corticosteroids or corticotropin, since each gram of sodium bicarbonate contains 12 mEq of sodium.

Use in the elderly

No data available.

Paediatric use

Rapid injection (10 mL/min) of hypertonic Sodium Bicarbonate Injection solutions into neonates and children under 2 years of age may produce hypernatraemia, a decrease in cerebrospinal fluid pressure and possible intracranial haemorrhage. In emergency situations, such as cardiac arrest, the risk of rapid infusion of the drug must be weighed against the potential for death from acidosis. It should also be noted that administration of sodium bicarbonate to children undergoing cardiopulmonary resuscitation may worsen respiratory acidosis. Do not administer more than 8 mmol/kg/day (see Section 4.2 Dose and Method of Administration).

Effects on laboratory tests

False positive Labstix® for urine protein may result due to the high urinary alkalinity produced by sodium bicarbonate.

4.5 INTERACTIONS WITH OTHER MEDICINES AND OTHER FORMS OF INTERACTIONS

Alkalinisation of the urine leads to increased renal clearance of acidic drugs such as salicylates, tetracyclines, (especially doxycycline), barbiturates and tricyclic antidepressants. Conversely, it prolongs the half-life and duration of basic drugs such as quinidine, amphetamines, ephedrine and pseudoephedrine and may result in toxicity.

Sodium bicarbonate enhances lithium excretion.

Solutions containing sodium ions should be used with great care, if at all, in patients receiving corticosteroids or corticotropin.

Hypochloraemic alkalosis may occur if sodium bicarbonate is used in conjunction with potassium depleting diuretics such as bumetanide, ethacrynic acid, frusemide and thiazides. Concurrent use in patients taking potassium supplements may reduce serum potassium concentration by promoting an intracellular ion shift.

The following drug may have enhanced or prolonged effects due to concomitant administration with sodium bicarbonate: flecainide.

The following drugs may have decreased effectiveness due to concomitant administration with sodium bicarbonate: aspirin and other salicylates, barbiturates and lithium.

The following drugs have been reported to be susceptible to inactivation on mixing with sodium bicarbonate solution: adrenaline HCl, benzylpenicillin potassium, carmustine, glycopyrrolate, isoprenaline HCl and suxamethonium chloride.

Compatibility/ Incompatibility

Sodium Bicarbonate Injection 8.4% can be diluted with 5% glucose injection or 0.9% sodium chloride injection. To reduce microbiological hazard, use as soon as practicable after dilution. If storage is necessary, hold at 2°C-8°C for not more than 24 hours. (See Section 4.2 Dose and Method of Administration).

Sodium bicarbonate is incompatible with certain substances in solution and specialised literature should be consulted.

See also Section 6.2 Incompatibilities.

4.6 FERTILITY, PREGNANCY AND LACTATION

Effects on fertility

No data available.

Use in pregnancy

Animal reproduction studies have not been conducted with sodium bicarbonate. Safety in pregnancy has not been established.

The use of Sodium Bicarbonate Injection, as with any drug, in pregnant women should only be undertaken if the expected benefit outweighs the possible risk to the mother and fetus.

Use in lactation

Safety in lactation has not been established.

The use of Sodium Bicarbonate Injection, as with any drug, in lactating women should only be undertaken if the expected benefit outweighs the possible risk to the mother and child.

4.7 EFFECTS ON ABILITY TO DRIVE AND USE MACHINES

The effects of this medicine on a person's ability to drive and use machines were not assessed as part of its registration.

4.8 ADVERSE EFFECTS (UNDESIRABLE EFFECTS)

Metabolic alkalosis and/or hypokalaemia may ensue as a result of prolonged use or over correction of the bicarbonate deficit, especially in patients with impaired renal function (see Section 4.9 Overdose). Metabolic alkalosis may be accompanied by compensatory hyperventilation, paradoxical acidosis of the cerebrospinal fluid, severe hypokalaemia, hyperirritability or tetany.

Hypernatraemia has been reported with sodium bicarbonate use, especially in patients with renal disease.

Hyperosmolality has also been associated with sodium bicarbonate use.

Accidental extravasation of intravenous hypertonic solutions of sodium bicarbonate has been reported to cause chemical cellulitis, with tissue necrosis, tissue calcification, ulceration or sloughing at the site of infiltration. Prompt elevation of the part, warmth and local injection of lignocaine or hyaluronidase are recommended to prevent sloughing of extravasated intravenous infusions. Hyperirritability or tetany may occur, caused by rapid shifts of free ionised calcium or due to serum protein alterations arising from the pH changes.

Cerebral oedema has occurred with sodium bicarbonate use and a possibility of intracranial haemorrhage exists.

Hypercapnia has occurred in patients receiving sodium bicarbonate and with fixed ventilation.

Reporting suspected adverse reactions

Reporting suspected adverse reactions after registration of the medicinal product is important. It allows continued monitoring of the benefit-risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions at www.tga.gov.au/reporting-problems.

4.9 OVERDOSE

Alkalosis is a result of overdosage.

Symptoms of overdosage

Symptoms include mood changes, tiredness, slow breathing, muscle weakness and irregular heartbeat. Muscle hypertonicity, twitching and tetany may develop, especially in hypocalcaemic patients.

Metabolic alkalosis, which may be accompanied by compensatory hyperventilation, paradoxical acidosis of the cerebrospinal fluid, severe hypokalaemia, hyperirritability or tetany.

Treatment of overdosage

Treatment of metabolic alkalosis associated with bicarbonate overdose consists mainly of appropriate correction of fluid and electrolyte balance. Replacement of calcium, chloride and potassium ions may be of particular importance.

The bicarbonate should be stopped and the patient managed according to the degree of alkalosis present. To control the symptoms of alkalosis the patient should rebreathe expired air. Sodium chloride injection 0.9% may be given intravenously; potassium chloride also may be indicated if there is hypokalaemia.

Calcium gluconate may be used to control hyperirritability and tetany which can occur in severe alkalosis. Ammonium chloride may also be indicated as an acidifying agent in severe cases (except in patients with pre-existing hepatic disease).

Treatment of hypernatraemia usually requires water replacement; restricted sodium intake and oral water may be sufficient. If more severe, glucose 5% may be administered by slow intravenous infusion. If total body sodium is too high, loop diuretics combined with an infusion of glucose 5% and potassium supplementation may be necessary.

For information on the management of overdose, contact the Poisons Information Centre on 131126 (Australia).

5 PHARMACOLOGICAL PROPERTIES

5.1 PHARMACODYNAMIC PROPERTIES

Mechanism of action

Sodium bicarbonate is a systemic alkalinizing agent which, when given intravenously, will increase plasma bicarbonate, buffer excess hydrogen ion concentration, raise blood pH and reverse the clinical manifestations of acidosis.

Sodium bicarbonate dissociates in water to provide sodium and bicarbonate ions (HCO_3^-). Sodium is the principal cation of the extracellular fluid and plays a large part in the therapy of fluid and electrolyte disturbances. Bicarbonate is a normal constituent of body fluids and the normal plasma level ranges from 24 to 31 mmol/L.

Acid-base homeostasis exerts a major influence on protein function, thereby critically affecting tissue and organ performance. Systemic arterial pH is maintained by extracellular and intracellular chemical buffering together with respiratory and renal regulatory mechanism. The control of arterial carbon dioxide (CO_2) tension (Pa_{CO2}) by the central nervous system and respiratory systems and the control of the plasma bicarbonate by the kidneys stabilize the arterial pH by excretion or retention of acid or alkali. Under most circumstances, CO_2 production and excretion are matched, and the usual steady-state Pa_{CO2} is maintained at 40 mmHg. The kidneys regulate plasma HCO_3^- through three main processes: (1) "reabsorption" of filtered HCO_3^-, (2) formation of titratable acid, and (3) excretion of NH_4^+ in the urine. The kidney filters approximately 4000 mmol of HCO_3- per day. To reabsorb the filtered load of HCO_3^-, the renal tubules must therefore secrete 4000 mmol of hydrogen ions. Between 80 and 90% of HCO_3^- is reabsorbed in the proximal tubule. The distal nephron reabsorbs the remainder and secretes protons, as generated from metabolism, to defend systemic pH. While this quantity of protons, 40 to 60 mmol/d, is small, it must be secreted to prevent chronic positive H^+ balance and metabolic acidosis. This quantity of secreted protons is represented in the urine as titratable acid and NH_4^+. Metabolic acidosis in the face of normal renal function increases NH_4^+ production and excretion. NH_4^+ production and excretion are impaired in chronic renal failure, hyperkalaemia, and renal tubular acidosis.

The management of serious acid-base disorders always demands precise diagnosis and treatment of the underlying disease, and in certain circumstances, it requires steps to combat the deviation in systemic acidity itself. Administration of sodium bicarbonate will increase the plasma HCO_3^- concentration and help restore the plasma pH within the normal range (pH 7.35-7.45). Changes in acid base balance also stimulate compensatory ion exchange mechanisms. When the extracellular hydrogen ion concentration increases, as in acidosis, there is a redistribution of potassium ions from intracellular to extracellular fluid. Administration of sodium bicarbonate can cause a redistribution of potassium ions into cells in patients with acidosis, by increasing the plasma pH.

The urinary pH will be increased by sodium bicarbonate in patients with normal renal function. Alkalinising the urine can increase the solubility of certain weak acids and can increase the ionisation and urinary excretion of lipid soluble organic acids (e.g. phenobarbitone, salicylates).

Metabolic acidosis

Metabolic acidosis is characterised by a primary decrease in serum bicarbonate (HCO_3^-) concentration to below 24 mmol/L and a compensatory decrease in the CO_2 concentration. It occurs from either loss of bicarbonate (HCO_3^-) or addition of hydrogen ion (H^+). Bicarbonate loss generally occurs through the kidneys or the bowel. Acidosis from decreased acid renal excretion generally is slow to develop. In contrast, acidosis from increased acid production, as in lactic acidosis or ketoacidosis, can exceed maximal renal excretion and cause a rapidly developing, severe acidosis.

Standard texts and institutional protocols should be consulted on the aetiology and management of metabolic acidosis.

Clinical trials

No data available.

5.2 PHARMACOKINETIC PROPERTIES

Distribution

No data available.

Metabolism

No data available.

Excretion

No data available.

5.3 PRECLINICAL SAFETY DATA

Genotoxicity

No data available.

Carcinogenicity

No data available.

6 PHARMACEUTICAL PARTICULARS

6.1 LIST OF EXCIPIENTS

The excipients are disodium edetate and water for injections.

6.2 INCOMPATIBILITIES

Sodium bicarbonate is incompatible with certain substances in solution and specialised literature should be consulted.

Incompatible fluids / medicines

Sodium bicarbonate is incompatible with acids, acidic salts and many alkaloidal salts. Sodium bicarbonate solutions should not be mixed with calcium or magnesium salts, cisplatin, dobutamine hydrochloride, labetalol

hydrochloride or oxytetracycline hydrochloride as this may result in formation of insoluble precipitates. Sodium bicarbonate is also incompatible with corticotropin, hydromorphone hydrochloride, insulin, magnesium sulfate, methicillin sodium, narcotic salts, noradrenaline acid tartrate, pentobarbitone sodium, procaine hydrochloride, promazine hydrochloride (in glucose injection), streptomycin sulfate, tetracycline hydrochloride, thiopentone sodium, vancomycin hydrochloride, lactated Ringer's injection, sodium lactate injection or Ringer's injection.

The co-administration with other drugs is not recommended; medicines should not be added to, or run through the same giving set as sodium bicarbonate. Before the administration of other drugs, the cannula and intravenous tubing must be carefully irrigated with a 5 to 10 mL bolus of 0.9% sodium chloride injection following administration of sodium bicarbonate to avoid inactivation and precipitation.

The addition of sodium bicarbonate to solutions containing calcium should be avoided except where compatibility has been shown. Solutions turning hazy as a result of sodium bicarbonate/calcium admixtures should be discarded.

6.3 SHELF LIFE

In Australia, information on the shelf life can be found on the public summary of the Australian Register of Therapeutic Goods (ARTG)[1]. The expiry date can be found on the packaging.

6.4 SPECIAL PRECAUTIONS FOR STORAGE

Store below 30°C. Do not freeze.

6.5 NATURE AND CONTENTS OF CONTAINER

84 g/100 mL (8.4%)

100 mL glass vial in packs of 1, 5 and 10. *Not all pack sizes may be marketed.*

Phebra product code - INJ127.

840 mg/10 mL (8.4%)

10 mL glass vial as a pack of 10.

Phebra product code - INJ099.

6.6 SPECIAL PRECAUTIONS FOR DISPOSAL

In Australia, any unused medicine or waste material should be disposed of in accordance with local requirements.

6.7 PHYSICOCHEMICAL PROPERTIES

The pH is approximately 7.0-8.5.

Chemical Structure

The molecular weight of sodium bicarbonate is 84.01. The molecular formula is $NaHCO_3$.

[1] AUST R 48376; AUST R 131067

CAS number

144-55-8

7 MEDICINE SCHEDULE (POISONS STANDARD)

UNSCHEDULED.

8 SPONSOR

Phebra[2] Pty Ltd, 19 Orion Road, Lane Cove West, NSW 2066, Australia
Telephone: 1800 720 020

Distributed in New Zealand: AFT Pharmaceuticals Ltd, PO Box 33-203 Takapuna Auckland

9 DATE OF FIRST APPROVAL

23 May 1994

10 DATE OF REVISION

19 Feb 2021

SUMMARY TABLE OF CHANGES

Section Changed	Summary of new information
All	PI reformatted to align with new form.
5.1	Typographical correction.
6.5	Minor editorial change.
7	Minor formatting change.

[2] Phebra and the Phi symbol are trademarks of Phebra Pty Ltd, 19 Orion Road, Lane Cove West, NSW 2066, Australia.