QRS interval prolongation

Cardiac sodium channel blockade causes prolongation of the QRS interval. Sodium channel blockade may benefit from sodium bicarbonate.

The normal QRS interval

- Normal QRS duration is 80-100ms
- Minority of individuals: QRS duration of 100-120ms
- A QRS duration of > 120ms is abnormal

Causes of a prolonged QRS interval

- Ventricular enlargement
- Bundle branch block
- Ventricular ectopic complexes
- Ventricular paced rhythms
- Drug induced cardiac sodium (Na) channel blockade

Common drugs with Na channel blockade properties

- Tricyclic antidepressants (TCAs)
- Propranolol / flecainide
- Local anesthetics including cocaine
- Phenothiazines
- Venlafaxine / desvenlafaxine
- Lamotrigine
- Chloroquine / hydroxychloroquine
- Orphenadrine
- Carbamazepine
- Diphenhydramine

ECG manifestations of tricyclic antidepressant and cocaine induced Na channel blockade

- Sinus tachycardia (bradycardia is an ominous sign as it suggests extreme Na channel blockade)
- QRS duration > 120ms (a sensitive, but non-specific finding)
- Upright R wave in lead aVR (R wave > 70% of amplitude of S wave)

ECG manifestations of other cardiac Na channel blocking drugs

- QRS duration > 120ms. Heart rate may vary (e.g., propranolol bradycardia, diphenhydramine tachycardia)
- The incidence and prognostic implications of an upright R wave in lead aVR is poorly defined

Management of drug induced cardiac Na channel blockade

- Continuous cardiac monitoring. Correct any electrolyte abnormalities (maintain K^+ conc. 4.5-5.0 mmol/L)
- Serum alkalinization via administration of 8.4% $NaHCO_3$ and control of ventilation
  - *Effective for treating Na channel blockade caused by TCAs and local anesthetics (including cocaine)*
  - *Effectiveness of serum alkalinization for other Na channel blocking drugs is variable, and may be ineffective*
- To achieve serum alkalinization (serum pH 7.50-7.55)
  - Patients with CNS depression undergoing serum alkalinisation should be intubated
  - Administer 1-2 mL/kg 8.4% $NaHCO_3$ slow IV bolus. Repeat 10-15 minutely to achieve target serum pH
  - Monitor response via VBG measurement of serum pH 5-minutely post $NaHCO_3$ administration
  - **While administering 8.4% $NaHCO_3$, hyperventilate aiming for $PaCO_2$ 30-35 mmHg**
  - **DO NOT exceed: total dose of 8.4% $NaHCO_3$ of 6 ml/kg, serum pH 7.55, serum Na of 155 mmol/L**
  - Once serum alkalinization has been achieved, maintain via hyperventilation
  - There is no proven role for administration of $NaHCO_3$ as an infusion
- Monitor and correct complications of $NaHCO_3$ therapy, particularly hypokalaemia