Research Paper for a Medication Training Gap

Drug: Lidocaine

Name:

DOB:

For Application of ACP

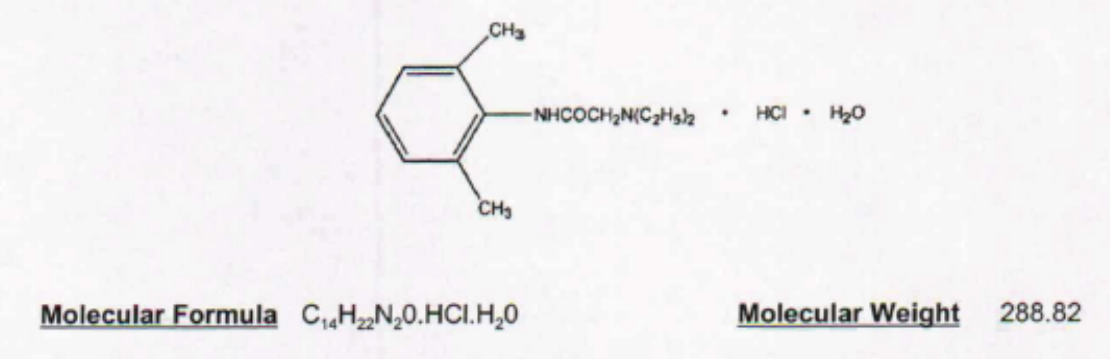
DRUG: Lidocaine

Classification:

Class IB Anti-Arrhythmic and Local Anaesthetic

Pharmacodynamics:

Lidocaine alters signal conduction in neurons by blocking the fast voltage-gated Na^+ channels in the neuronal cell membrane responsible for signal propagation. With adequate blockage, the membrane of the postsynaptic neuron will not depolarize and will therefore fail to transmit an action potential (Carterall, 2001). Blocking sodium channels in the conduction system, as well as the muscle cells of the heart, raises the depolarization threshold, making the heart less likely to initiate or conduct early action potentials that may cause an arrhythmia (Sheu & Lederer, 1985).



Health Canada (2005)

Pharmacokinetics:

Lidocaine is rapidly metabolised in the liver, primarily via CYP1A2 and CYP3A4-mediated oxidative N-deethylation to monoethylglycine-xylidide (MEGX), then further metabolised to glycinexylidide (GX). These two compounds are pharmacologically active, but less potent than the parent drug (Buck, 2013).

The following is based on intra-venous administration: (Nelson & Goldfrank, 2011)

- The onset of action = 45 - 90 seconds
- The peak effect - Unable to find/None
- The duration of action has been found to be between 10-20 minutes.
- The half-life in initial phase 8-15mins followed by a terminal phase of 90-120 minuets

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Indications:

Lidocaine is indicated for use in the treatment of:

1. Haemodynamically significant ventricular ectopic
   - Closely joined ventricular beats (R on T phenomenon), or multiform PVCs
   - Bursts of three or more ventricular beats at a rate > 100
   - Sustained VT with a pulse

2. Pulseless ventricular tachycardia or ventricular fibrillation

(Bctg.bcas.ca, 2015)

Contraindications:

As listed by BCAS Guidelines and Health Canada (2005):

- Allergy or hypersensitivity to Lidocaine
- 3rd degree AV block, ventricular escape rhythms, WPW – Note: although 2nd degree AV block is also indicated as a contraindication, it is in effect, a supra-ventricular rhythm. If it appeared as a post arrest rhythm, benefits of administering Lidocaine to prevent recurrence of VF or VT outweigh the theoretical risks.
- Stokes-Adams Syndrome
- Advance Hepatic Disease (Listed as Caution by BCAS)

Relative Contraindications are also listed as:

- CHF, Cardiogenic shock
- Ventricular ectopy/VT secondary to cocaine ingestion,
  Note: There is an increased risk of seizure due to the synergistic toxic effects of these two agents.

Cautions:

- Patients who have congestive heart failure, shock, liver disease
- Patients over 70 Years old - they may require a smaller dose
- Unconscious patients
- Solutions that contain dextrose should be used with known diabetic patients
- Advance Hepatic Disease (Listed as Contraindication by Health Canada (2005)
- The use of Lidocaine with respect to the development of the human foetus has not been adequately established. The risk benefit ratio should be determined when the use of Lidocaine in early pregnancy is considered.

Health Canada (2005), (Bctg.bcas.ca, 2015)

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Side Effects:

Central Nervous System
Nervousness, dizziness, blurred or double vision, tinnitus, nausea, vomiting, numbness, convulsions, slurred speech.

Cardiovascular
Myocardial Depression, hypotension, bradycardia and cardiac and respiratory arrest.

Allergic Reactions
N/V, rash, anaphylactic reaction seizures secondary to Lidocaine toxicity. Oedema, urticaria and lesions.

Health Canada (2005), (Bctg.bcas.ca, 2015)

Drug interactions:

There is an increased risk of Lidocaine toxicity when given to patients taking cimetidine, ranitidine or beta-blocking agents.

Administering Lidocaine to patients on disopyramide may cause bradycardia or cardiac arrest.

(Bctg.bcas.ca, 2015)

Parenteral Administration:

The use of Lidocaine for the treatment outlined in the indications is via intravenous access.

Dosage:

Adult Patients:

1.0-1.5mg/ kg - IV Bolus
2.0mg/kg - If given By ETT if IV not available

Followed by 0.5 - 1.0 mg/kg bolus repeat as needed to max of 3 mg/kg

Paediatric Patients:

Same as adult

Health Canada (2005), (Bctg.bcas.ca, 2015)

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How Supplied:

Depending on the area of work or supplier, the availability of Lidocaine can be presented in many forms. For single intravenous injections the following presentations are available:

1% and 2% Lidocaine can be supplied in 5ml ABBOJECT or 5ml AnSYR syringes.

The composition for each presentation is as follows:

1% = 7mg/ml

2% = 6mg/ml

Health Canada (2005),

Special Considerations:

It is always important to treat the underlying cause of the ventricular ectopic first before administration. Causes could be as a result of cardiac ischemia, electrolyte imbalance, hypoxemia, hypovolemia, etc.

(Bctg.bcas.ca, 2015)

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Patient Application

Conditions Medication could be used In:

Lidocaine is suitable for infiltration, block and surface anaesthesia for the treatments of finger amputation and suturing open lacerations/wounds. There is tentative evidence for topical uses Lidocaine for neuropathic pain (Cochrane Database of Systematic Reviews, 1996). Intravenous Lidocaine also has uses as a temporary fix for tinnitus, having been shown to reduce the effects by around two-thirds (Tayyar-Kalcioglu, et al, 2005). Lidocaine can also be used as an antitussive (cough suppressor) acting peripherally to reduce the cough reflex (Adcock et al., 2003).

It has also been proven to be effective in treating jellyfish stings, both numbing the affected area and preventing further nematocyst discharge (Birsa, Verity & Lee, 2010).

It is more commonly recognised for its uses in anti-arrhythmic management of patients intravenously.

Indication for use:

Within British Columbia treatment guidelines, the indications for use are as follows:

1. Haemodynamically significant ventricular ectopic
   - Closely joined ventricular beats (R on T phenomenon), or multiform PVCs
   - Bursts of three or more ventricular beats at a rate > 100
   - Sustained VT with a pulse

2. Pulseless ventricular tachycardia or ventricular fibrillation (Cardiac Arrest)
   As a second line anti-dysrhythmic (not interfering with good quality CPR and defibrillation)

Treatment Contraindications:

As listed by BCAS Guidelines and Health Canada (2005):

- Allergy or hypersensitivity to Lidocaine
- 3rd degree AV block, ventricular escape rhythms, WPW – Note: although 2nd degree AV block is also indicated as a contraindication, it is in effect, a supra-ventricular rhythm. If it appeared as a post arrest rhythm, benefits of administering Lidocaine to prevent recurrence of VF or VT outweigh the theoretical risks.
- Stokes-Adams Syndrome
- Advance Hepatic Disease (Listed as Caution by BCAS)

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Protocol Sequencing:

Lidocaine sits within a protocol structure for the management of VT or VF/Pulseless VT in cardiac arrest. It is a second line anti-dysrhythmic for use if amiodarone is not available and can also follow amiodarone administration if it was not successful. It is given refractory to defibrillation. This is commonly administered after the third shock and followed by a second dose after the 5th, although some countries may differ slightly in cardiac arrest management protocol.

Treatment Objectives:

Essentially, the administration of Lidocaine is not a priority in the management of a cardiac arrest. Early defibrillation is essential to success in witnessed ventricular fibrillation or pulseless ventricular tachycardia (VF/VT) arrest along with high quality CPR.

BCAS Guidelines state, it is not acceptable to stop chest compressions or delay defibrillations for procedures or drugs that have not been proven effective. This includes advanced airway management and anti-arrhythmic therapy. CPR is a proven therapy and should not be interrupted other than to analyze the rhythm or defibrillate the patient.

Vital Sign Requirements:

As within any clinical patient presentation and treatment, vital signs are required.

Management of Pulse VT:

If this medication was to be given for management for the treatment of a pulsed VT patient, a full set of observations would be required, with a 3 and 12 lead ECG. Proactive defibrillation pad placement would be used and rescue drugs easily to hand.

Other observations (including time taken) as well as a physical assessment should include:

Pulse rate
Respiratory Rate
Blood Pressure
Sp02
Glasgow Coma Scale (GCS)
Pupils
Blood Sugar

Management of a VF/VT cardiac arrest:

An ABC approach would be used to manage a patient of this type.

Observations which would assist in the management of this would an ETC02 and Sp02 to confirm successful airway and breathing management. The patient would be connected to monitoring which would observe the rhythm. A blood glucose should also be taken to assess for revisable causes.

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Treatment Exit Requirements:

Management of Pulse VT:

As with any clinical intervention, a full reassessment of the patient must be undertaken.
As mentioned previously, a full set of observations should be ascertained as part of this re-assessment along with a full ECG recording and 12 Lead ECG.

If the patient has been successfully managed with Lidocaine and has returned to NSR, they should be made comfortable, continuously monitored and taken to the most appropriate receiving ED.

Management of a VF/VT cardiac arrest:

If successful resuscitation has taken place, a full re-assessment of all the patient observations would take place as listed in vital sign requirements. Some treatment options and exit requirements could be dependent on the clinical condition of the patient, such as GCS.

- Airway and breathing should be assessed to allow the most appropriate form of management with ETC02.
- Fluid therapy may be necessary depending on the patients clinical findings.
- Post ROSC adrenaline is now also been used to manage patients who are hypotensive and potentially bradycardic. .
- Midazolam could also be used to assist in the management of an agitated patient post ROSC.

The patient is still at high risk of a potential further arrest, therefore pacing and/or cardioversion may be required along with further drug interventions such as atropine.

The patient should be transferred to the most appropriate receiving healthcare facility.

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References:

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