25. SYRINGE DRIVERS

Syringe drivers are used to aid drug delivery when the oral route is no longer feasible.

**INDICATIONS FOR USE:**
1) INTRACTABLE VOMITING
2) SEVERE DYSPHAGIA
3) PATIENT TOO WEAK TO SWALLOW ORAL DRUGS
4) DECREASED CONSCIOUS LEVEL
5) POOR ALIMENTARY ABSORPTION (RARE)
6) POOR PATIENT COMPLIANCE
THE FOLLOWING DRUGS MAY BE MIXED WITH DIAMORPHINE:-

cyclizine  
glycopyrronium  
haloperidol  
hyoscine butylbromide  
hyoscine hydrobromide  
levomepromazine  
metoclopramide  
midazolam  
octreotide  
ondansetron

DRUGS NOT SUITABLE FOR SUBCUTANEOUS USAGE:-

diazepam  
chlorpromazine  
prochlorperazine

USE SEPARATE SYRINGE DRIVER FOR:-

dexamethasone  
phenobarbital  
diclofenac  
ketamine  
ketorolac

CONVERSION OF ORAL MORPHINE (or oral morphine equivalent) TO PARENTERAL DIAMORPHINE

morphine 3mg oral = diamorphine 1mg SC

METHOD  Add the total daily oral dose of morphine (or oral morphine equivalent) and divide by three.

e.g.  morphine 10mg oral 4h =
or  
MST 30mg b.d. = morphine 60mg oral 24h
or  
MXL 60mg o.d. =

morphine 60mg oral 24h = diamorphine 20mg SC in 24h
GENERAL PRINCIPLES

- Care should be taken when mixing more than two drugs in a syringe and in ensuring that the diluent used is compatible with the drugs. Water for injection or 0.9% sodium chloride can be used as a diluent but water must be used with cyclizine and doses of diamorphine > 40mg per ml

- If requiring more than three drugs in one syringe driver, re-assessment of treatment aims is required.

- With combinations of two or three drugs in one syringe, a larger volume of diluent may be needed, e.g. 20ml or 30ml syringe.

PREPARATION OF SYRINGE DRIVER

The following is an example only, to illustrate the principle; local practices may differ. Training is essential.

IMPORTANT - CHECK TYPE OF PORTABLE GRASEBY SYRINGE DRIVER

We strongly encourage that each health care trust should use only one type of syringe driver to decrease risks of dose errors.

<table>
<thead>
<tr>
<th>Blue Driver Hourly Rate</th>
<th>Green Driver Daily Rate</th>
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</thead>
</table>

Draw up prescribed 24 hour medication mixed with water for injection as diluent. (Use sodium chloride 0.9% as diluent with levomepromazine)

Set the rate on the syringe driver.
(The rate of delivery is based on a length of fluid in mm per unit time).

For example:

**MS 26 - GREEN**  (mm per 24 hours, a *daily* rate)

\[
\text{rate} = \frac{\text{measured 'length of volume' in mm}}{\text{delivery time in days}}
\]

\[
e.g. \quad 48 \text{ mm} = 48 \text{ mm per day}
\]

Rate on dial is 48

**MS 16 A – BLUE**  (mm per hour)

\[
\text{rate} = \frac{\text{measured 'length of volume' in mm}}{\text{delivery time in hours}}
\]

\[
e.g. \quad 48 \text{ mm} = 2\text{ mm per hour}
\]

\[
\frac{24\text{ h}}{}
\]

Rate on dial is 02
PROBLEMS

Infusion running too fast: Check the rate setting and recalculate.
Infusion running too slow: Check start button, battery, syringe driver, cannula and make sure injection site is not inflamed.

Site reaction: Cyclizine and levomepromazine cause site reactions most commonly. Firmness or swelling is not necessarily a problem but the needle site should be changed if there is pain or obvious inflammation. If there is no alternative to subcutaneous administration of drugs it may be helpful to add dexamethasone 1mg to the mixture. A plastic/teflon needle may reduce local irritation if there is a nickel allergy

Precipitation

Check compatibility of drugs.

Check solution regularly for precipitation and discolouration and discard if it occurs. Cyclizine may precipitate at high doses, particularly in combination with high doses of diamorphine. Other combinations may also cause cloudiness in the syringe. On rare occasions a patient may need two or three separate syringe drivers to separate the drugs.

Light flashing

This is normal. The light flashes:-
BLUE - Once per second   GREEN - Once per 25 seconds

Flashing will stop when the battery needs changing. The syringe driver will continue to operate for 24 hours after the light has stopped flashing.

Alarm

This always sounds when the battery is inserted. It can be silenced by pressing Start/Test button. Check for - empty syringe - kinked tube - blocked needle/tubing - jammed plunger.
Drug Compatibilities – usually maximum 3 drugs in one syringe

(Examples Of Commonly Used Syringe Driver Preparations)

<table>
<thead>
<tr>
<th>Drug Combination</th>
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</thead>
<tbody>
<tr>
<td>Diamorphine + Haloperidol + Cyclizine**</td>
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<tr>
<td>Diamorphine + Haloperidol + Hyoscine Hydrobromide</td>
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<tr>
<td>Diamorphine + Haloperidol + Hyoscine Butylbromide</td>
</tr>
<tr>
<td>Diamorphine + Haloperidol + Levomepromazine***</td>
</tr>
<tr>
<td>Diamorphine + Haloperidol + Midazolam</td>
</tr>
<tr>
<td>Diamorphine + Cyclizine** + Hyoscine Hydrobromide</td>
</tr>
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</tr>
<tr>
<td>Diamorphine + Midazolam + Levomepromazine***</td>
</tr>
<tr>
<td>Diamorphine + Midazolam + Glycopyrrolate</td>
</tr>
<tr>
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</tr>
<tr>
<td>Diamorphine + Levomepromazine*** + Hyoscine Butylbromide</td>
</tr>
<tr>
<td>Diamorphine + Levomepromazine*** + Glycopyrrolate</td>
</tr>
</tbody>
</table>

**Cyclizine is incompatible with normal saline.**

If needing to use a dose of cyclizine greater than 75mg/24 hours in conjunction with a dose of diamorphine greater than 160mg/24 hours, a 20 ml BD syringe containing 0.9% sodium chloride as diluent should be used. This will enable dilution to 14 ml so that the medication remains compatible in the syringe.

*** Levomepromazine can be irritant.***

If skin site soreness becomes a problem, it is recommended to dilute it with 0.9% saline rather than water for injections. However, please note if diamorphine is combined with Levomepromazine, 0.9% sodium chloride can only be used when diamorphine concentration is less than 40mg/ml. If the diamorphine concentration exceeds 40mg/ml, water for injections should be used. If skin site soreness is a problem in this instance, increase the size of syringe used. If other drugs are in the syringe, check these are compatible with saline.
# COMMON DRUGS, DOSES AND RANGES FOR PALLIATIVE CARE USE WITH A 24 HOUR SYRINGE DRIVER

The following is a guide to drugs that may be used subcutaneously in a 24 hour syringe driver. They may be used alone or in combinations. Advice should be sought when combining drugs.

All drugs should be mixed with WATER unless otherwise indicated.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Class of drug/ (ampoule size)</th>
<th>Indications</th>
<th>Compatibility</th>
<th>Contraindications</th>
<th>Possible Side Effects</th>
<th>P.R.N. dose Onset of action</th>
<th>24h infusion dose ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclizine</td>
<td>Antihistaminic, antimuscarinic antiemetic (50mg/ml)</td>
<td>Nausea and vomiting associated with motion sickness Anticipatory nausea Pharyngeal stimulation Mechanical bowel obstruction Raised intracranial pressure</td>
<td>Can precipitate with dexamethasone, diamorphine (in higher doses), metoclopramide, midazolam and 0.9% sodium chloride</td>
<td>No absolute ones in patients with advanced cancer Do not give with metoclopramide Do not give with levomepromazine Do not give with Buscopan</td>
<td>Drowsiness Dry mouth Blurred vision Hypotension Injection can be painful Can be sedating If syringe driver site is inflamed try to dilute further</td>
<td>50mg SC / i/m every 8 hours</td>
<td>50mg-150mg usual dose</td>
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<tr>
<td>Dexamethasone</td>
<td>Corticosteroid (4mg/ml)</td>
<td>Antiemetic Pain relief Raised intracranial pressure Spinal cord compression Intestinal obstruction Syringe driver site reaction N.B. It is unusual to give dexamethasone in a SD except as a trial in intestinal obstruction (limited evidence base) and for site reaction.</td>
<td>Mixes with metoclopramide Precipitates with cyclizine midazolam haloperidol levomepromazine Advisable to put in separate driver but can mix with diamorphine</td>
<td>Diabetes - may need supervision Gastro intestinal side effects Impaired healing Weight gain Hirsutism Increased appetite Discuss with oncology /palliative care team Not usually needed</td>
<td>4mg -16 mg usual dose</td>
<td>1 mg for SD site reaction</td>
<td></td>
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<tr>
<td>Diamorphine</td>
<td>Opioid analgesic (5mg, 10mg, 30mg, 100mg, 500mg)</td>
<td>Pain</td>
<td>With most drugs</td>
<td>None if titrated carefully against a patient's symptoms</td>
<td>Nausea, Drowsiness, Dry mouth, Constipation, Confusion, Twitching/jerking</td>
<td>One sixth of total 24h infusion dose</td>
<td>Within 10-30 mins</td>
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<tr>
<td>Diclofenac</td>
<td>NSAID Non-opioid analgesic (75mg/3ml)</td>
<td>Pain (particularly associated with tissue inflammation or bone pain/movement related pain)</td>
<td>Incompatible with most drugs</td>
<td>Active peptic ulceration, Urticaria, Rhinitis, Asthma, Angioedema</td>
<td>Skin ulceration especially with prolonged use (SC)</td>
<td>75mg SC every 12 hours (do not give as well as the infusion)</td>
<td>Within 20-30 mins</td>
</tr>
<tr>
<td>Glycopyrronium bromide</td>
<td>Quaternary ammonium antimuscarinic (0.2mg/ml, 0.6 mg / 3ml)</td>
<td>Death rattle, Colic in inoperable bowel obstruction, Reduction of secretion</td>
<td>With most drugs</td>
<td>Tachycardia, Dry mouth</td>
<td>0.2mg SC every 6-8 hours</td>
<td>Within 20-40 mins</td>
<td>0.6mg - 1.2mg usual dose</td>
</tr>
<tr>
<td>Drug Class of drug/ (ampoule size)</td>
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<td><strong>Haloperidol</strong>&lt;br&gt;Butyrophenone&lt;br&gt;Antipsychotic (5mg/ml)</td>
<td>Nausea &amp; vomiting&lt;br&gt;Psychotic symptoms&lt;br&gt;Agitated delirium&lt;br&gt;Intractable hiccup</td>
<td>With most drugs</td>
<td>Parkinson's disease&lt;br&gt;Possible CNS Depression with anxiolytics &amp; alcohol</td>
<td>Extra pyramidal symptoms&lt;br&gt;Drymouth&lt;br&gt;Drowsiness&lt;br&gt;Difficulty in micturition&lt;br&gt;Hypotension&lt;br&gt;Blurred vision</td>
<td>1.5mg-3mg SC daily every 8 hours&lt;br&gt;may need 5mg SC stat in severe agitated delirium&lt;br&gt;Within 10-15mins</td>
<td>3mg - 5mg usual dose for nausea &amp; vomiting&lt;br&gt;Doses &gt;10mg should be avoided</td>
<td></td>
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<tr>
<td><strong>Hyoscine butylbromide</strong>&lt;br&gt;Antimuscarinic&lt;br&gt;Antispasmodic&lt;br&gt;Antisecretory (20mg/ml)</td>
<td>Obstructive symptoms with colic&lt;br&gt;Reduce secretions&lt;br&gt;Death rattle</td>
<td>With most drugs, except cyclizine</td>
<td>Narrow angle glaucoma (unless moribund)&lt;br&gt;Myasthenia gravis</td>
<td>Does not cross blood brain barrier so does not cause drowsiness</td>
<td>10mg - 20 mg SC every 4 hours&lt;br&gt;Within 3 - 5 mins</td>
<td>Bowel obstruction with colic: 40mg - 100mg usual dose</td>
<td></td>
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<tr>
<td>Hyoscine hydrobromide 0.4mg/ml or 0.6mg/ml</td>
<td>Death rattle  Colic  Reduce salivation  Some antiemetic action</td>
<td></td>
<td></td>
<td>Sedation</td>
<td>0.4mg</td>
<td>1.2-2.4mg</td>
<td></td>
</tr>
<tr>
<td>Levomepromazine  Phenothiazine Antipsychotic (25mg/ml)</td>
<td>Nausea &amp; vomiting  Insomnia  Terminal agitation  Intractable pain</td>
<td>Precipitates with dexamethasone  Do not use with cyclizine</td>
<td>Parkinson's disease  Postural hypotension  Antihypertensive therapy  Epilepsy  Hypothyroidism  Myasthenia gravis</td>
<td>Sedation  Dose dependent postural hypotension</td>
<td>6.25mg - 12.5mg SC/i/m every 4 - 6 hours usual dose within 30 minutes</td>
<td>6.25mg - 25mg usual dose for nausea &amp; vomiting  25mg-150mg usual dose for terminal agitation</td>
<td></td>
</tr>
<tr>
<td>Metoclopramide Prokinetic antiemetic (10mg/2ml)</td>
<td>Nausea and vomiting caused by gastric irritation  Delayed gastric emptying  Stimulation of the CTZ Obstructive bowel symptoms without colic  Non-sedating</td>
<td>With most drugs</td>
<td>Concurrent administration with antimuscarinic drugs  Concurrent i/v administration of 5HT3 receptor antagonists  Do not give in bowel obstruction if colic present</td>
<td>Dizziness  Diarrhoea  Depression  Extra pyramidal effects</td>
<td>10mg-20mg SC/i/m every 6 hours</td>
<td>60mg-120mg</td>
<td></td>
</tr>
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<tr>
<td><strong>Midazolam</strong>&lt;br&gt;Benzodiazepine&lt;br&gt;Anxiolytic&lt;br&gt;(10mg/2ml)</td>
<td><strong>Sedation for terminal agitation</strong>&lt;br&gt;<strong>Multifocal myoclonus</strong>&lt;br&gt;<strong>Epilepsy</strong>&lt;br&gt;<strong>Intractable hiccup</strong>&lt;br&gt;<strong>Muscle spasm</strong></td>
<td>With most drugs</td>
<td>Drowsiness&lt;br&gt;Hypotension</td>
<td>Dizziness&lt;br&gt;Drowsiness</td>
<td>2.5mg - 10mg SC every 4 hours&lt;br&gt;Within 5-10 mins</td>
<td>10mg - 60 mg usual dose</td>
<td></td>
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<tr>
<td><strong>Octreotide</strong>&lt;br&gt;Somatostatin analogue&lt;br&gt;FOR SPECIALIST USE ONLY&lt;br&gt;50micrograms/ml&lt;br&gt;100micrograms/ml&lt;br&gt;200micrograms/ml&lt;br&gt;500micrograms/ml</td>
<td><strong>Intestinal obstruction associated with vomiting</strong>&lt;br&gt;<strong>Intractable diarrhoea</strong>&lt;br&gt;<strong>Symptoms associated with hormone secreting tumours</strong>&lt;br&gt;<strong>Bowel fistulae</strong></td>
<td>Precipitates with dexamethasone</td>
<td>Caution in diabetes mellitus, may potentiate hypoglycaemia</td>
<td>Dry mouth&lt;br&gt;Nausea&lt;br&gt;Vomiting&lt;br&gt;Anorexia&lt;br&gt;Abdominal pain&lt;br&gt;Flatulence&lt;br&gt;Injection can be painful (hand warm the vial)</td>
<td>50 - 100 micrograms SC every 8 hours&lt;br&gt;within 30 mins</td>
<td>Intestinal obstruction: 300 - 600 micrograms usual dose</td>
<td></td>
</tr>
<tr>
<td><strong>Oxycodone</strong>&lt;br&gt;Opioid&lt;br&gt;10mg/ml&lt;br&gt;1ml and 2ml Amps</td>
<td><strong>Pain</strong></td>
<td>Incompatible with cyclizine</td>
<td>Moderate hepatic impairment severe renal impairment concurrent MAOI or within 2 weeks</td>
<td>As per other opioids</td>
<td>One sixth of total 24h dose&lt;br&gt;Within 5-10 mins</td>
<td>Titrate</td>
<td></td>
</tr>
</tbody>
</table>

* Incompatible with cyclizine when the concentration of cyclizine is >3 mg/ml (i.e. 60 mg in a standard 20 ml syringe). Cyclizine lactate is incompatible with 0.9% saline. However if a diluent is required when mixing low-dose cyclizine lactate and Oxycodone injection, use water for injections.
BACKGROUND READING SYRINGE DRIVERS

Books

Reviews