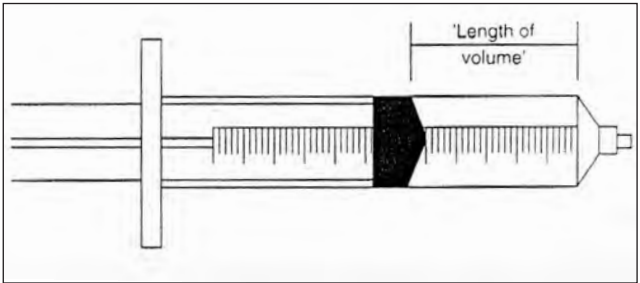
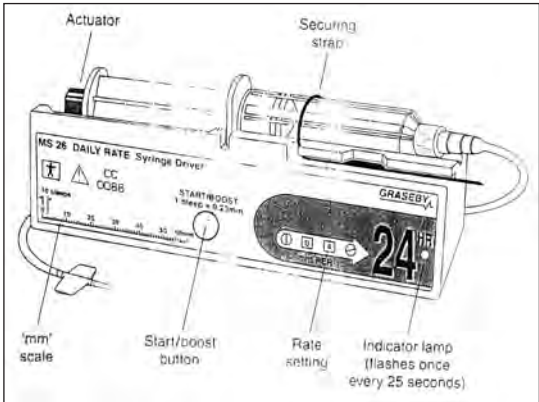


25. SYRINGE DRIVERS



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
- 4) POOR ALIMENTARY ABSORPTION (RARE)
- 5) POOR PATIENT COMPLIANCE

MORPHINE CONVERSION

Diamorphine can be administered subcutaneously in a smaller volume than morphine, and in countries where diamorphine is available is the preparation of first choice.

| | Oral morphine | SC diamorphine | SC morphine |
|--------------|---------------|----------------|-------------|
| RATIO | 3 | 1 | 2 |

When converting from opioids other than morphine, calculate the equivalent dose of oral morphine over 24 hours and continue as above.

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

Blue Driver Hourly Rate

Green Driver Daily Rate

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

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. 48 mm = 48 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. 48 mm = 2mm per hour
24 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)

| | | |
|-------------|----------------------|-------------------------|
| Diamorphine | + Haloperidol | + Cyclizine** |
| Diamorphine | + Haloperidol | + Hyoscine Hydrobromide |
| Diamorphine | + Haloperidol | + Hyoscine Butylbromide |
| Diamorphine | + Haloperidol | + Levomepromazine*** |
| Diamorphine | + Haloperidol | + Midazolam |
| Diamorphine | + Cyclizine** | + Hyoscine Hydrobromide |
| Diamorphine | + Cyclizine** | + Levomepromazine*** |
| Diamorphine | + Cyclizine** | + Midazolam |
| Diamorphine | + Midazolam | + Hyoscine Hydrobromide |
| Diamorphine | + Midazolam | + Hyoscine Butylbromide |
| Diamorphine | + Midazolam | + Levomepromazine*** |
| Diamorphine | + Midazolam | + Glycopyrrolate |
| Diamorphine | + Levomepromazine*** | + Hyoscine Hydrobromide |
| Diamorphine | + Levomepromazine*** | + Hyoscine Butylbromide |
| Diamorphine | + Levomepromazine*** | + Glycopyrrolate |

****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.

| Drug Class of drug/ (ampoule size) | Indications | Compatibility | Contraindications | Possible Side Effects | P.R.N. dose Onset of action | 24h infusion dose ranges |
|--|---|---|--|--|--|---|
| Cyclizine Antihistaminic, antimuscarinic antiemetic (50mg/ml) | Nausea and vomiting associated with motion sickness Anticipatory nausea Pharyngeal stimulation Mechanical bowel obstruction Raised intracranial pressure | Can precipitate with dexamethasone, diamorphine (in higher doses), metoclopramide, midazolam and 0.9% sodium chloride | No absolute ones in patients with advanced cancer Do not give with metoclopramide Do not give with levomepromazine Do not give with Buscopan | Drowsiness Dry mouth Blurred vision Hypotension Injection can be painful Can be sedating If syringe driver site is inflamed try to dilute further | 50mg SC / i/m every 8 hours | 50mg-150mg usual dose |
| Dexamethasone Corticosteroid (4mg/ml) | 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. | Mixes with metoclopramide Precipitates with cycizine midazolam haloperidol levomepromazine Advisable to put in separate driver but can mix with diamorphine | Diabetes - may need supervision | Gastro intestinal side effects Impaired healing Weight gain Hirsutism Increased appetite | Discuss with oncology /palliative care team Not usually needed | 4mg -16 mg usual dose 1mg for SD site reaction |

| Drug Class of drug/ (ampoule size) | Indications | Compatibility | Contraindications | Possible Side Effects | P.R.N. dose Onset of action | 24h infusion dose ranges |
|---|--|--|---|---|--|--|
| Diamorphine Opioid analgesic (5mg, 10mg, 30mg, 100mg, 500mg) | Pain Dyspnoea Cough Diarrhoea | With most drugs | None if titrated carefully against a patient's symptoms Modify dose in renal failure | Nausea Drowsiness Dry mouth Constipation Confusion Twitching/jerking | One sixth of total 24h infusion dose Within 10-30mins | Variable depending on total oral intake of morphine Conversion of oral morphine to subcutaneous diamorphine is 3:1 |
| Diclofenac NSAID Non-opioid analgesic (75mg/3ml) | Pain (particularly associated with tissue inflammation or bone pain/movement related pain) | Incompatible with most drugs Give in a separate syringe driver Use 0.9% sodium chloride for dilution Do Not Mix | Active peptic ulceration Urticaria Rhinitis Asthma Angioedema | Skin ulceration especially with prolonged use (SC) | 75mg SC every 12 hours (do not give as well as the infusion) Within 20-30 mins | 75mg-150mg usual dose |
| Glycopyrronium bromide Quaternary ammonium antimuscarinic (0.2mg/ml, 0.6 mg / 3ml) | Death rattle Colic in inoperable bowel obstruction Reduction of secretion May be effective if no response to hyoscine's | With most drugs | | Tachycardia Dry mouth | 0.2mg SC every 6-8 hours Within 20-40 mins | 0.6mg - 1.2mg usual dose 2-5 times more potent than hyoscine hydrobromide |

| Drug Class of drug/ (ampoule size) | Indications | Compatibility | Contraindications | Possible Side Effects | P.R.N. dose Onset of action | 24h infusion dose ranges |
|---|---|--------------------------------------|--|---|---|---|
| | antisecretory effect Does not cross the blood brain barrier so does not cause drowsiness | | | | | |
| Haloperidol Butyrophenone Antipsychotic (5mg/ml) | Nausea & vomiting Psychotic symptoms Agitated delirium Intractable hiccup | With most drugs | Parkinson's disease Possible CNS Depression with anxiolytics & alcohol | Extrapyramidal symptoms Drymouth Drowsiness Difficulty in micturition Hypotension Blurred vision | 1.5mg- 3mg SC daily every 8 hours may need 5mg SC stat in severe agitated delirium Within 10-15mins | 3mg - 5mg usual dose for nausea & vomiting Doses >10mg should be avoided |
| Hyoscine butylbromide Antimuscarinic Antispasmodic Antisecretory (20mg/ml) | Obstructive symptoms with colic Reduce secretions Death rattle | With most drugs, except cyclizine | Narrow angle glaucoma (unless moribund) Myasthenia gravis | Does not cross blood brain barrier so does not cause drowsiness | 10mg - 20 mg SC every 4 hours Within 3 - 5 mins | Bowel obstruction with colic: 40mg - 100mg usual dose |

| Drug Class of drug/ (ampoule size) | Indications | Compatibility | Contraindications | Possible Side Effects | P.R.N. dose Onset of action | 24h infusion dose ranges |
|---|---|--|--|---|---|--|
| Hyoscine hydrobromide 0.4mg/ml or 0.6mg/ml | Death rattle Colic Reduce salivation Some antiemetic action | | | Sedation | 0.4mg | 1.2-2.4mg |
| Levomepromazine Antiemetic Phenothiazine Antipsychotic (25mg/ml) | Nausea & vomiting Insomnia Terminal agitation Intractable pain Can be very sedating | Precipitates with dexamethasone Do not use with cyclozine | Parkinson's disease Postural hypotension Antihypertensive therapy Epilepsy Hypothyroidism Myasthenia gravis | Sedation Dose dependent postural hypotension | 6.25mg - 12.5mg SC/IM every 4 - 6 hours usual dose within 30 minutes | 6.25mg - 25mg usual dose for nausea & vomiting 25mg-150mg usual dose for terminal agitation |
| Metoclopramide Prokinetic antiemetic (10mg/2ml) | Nausea and vomiting caused by gastric irritation Delayed gastric emptying Stimulation of the CTZ Obstructive bowel symptoms without colic Non-sedating | With most drugs | Concurrent administration with antimuscarinic drugs Concurrent i/v administration of 5HT3 receptor antagonists Do not give in bowel obstruction if colic present | Dizziness Diarrhoea Depression Extrapyramidal effects | 10mg-20mg SC/IM every 6 hours | 60mg-120mg |

| Drug Class of drug/ (ampoule size) | Indications | Compatibility | Contraindications | Possible Side Effects | P.R.N. dose Onset of action | 24h infusion dose ranges |
|--|---|------------------------------------|--|--|---|---|
| Midazolam Benzodiazepine Anxiolytic (10mg/2ml) | Sedation for terminal agitation Multifocal myoclonus Epilepsy Intractable hiccup Muscle spasm | With most drugs | Drowsiness Hypotension | Dizziness Drowsiness | 2.5mg - 10mg SC every 4 hours Within 5-10 mins | 10mg - 60 mg usual dose |
| Octreotide Somatostatin analogue FOR SPECIALIST USE ONLY 50micrograms/ml 100micrograms/ml 200micrograms/ml 500micrograms/ml | Intestinal obstruction associated with vomiting Intractable diarrhoea Symptoms associated with hormone secreting tumours Bowel fistulae | Precipitates with dexamethasone | Caution in diabetes mellitus, may potentiate hypoglycaemia | Dry mouth Nausea Vomiting Anorexia Abdominal pain Flatulence Injection can be painful (hand warm the vial) | 50 - 100 micrograms SC every 8 hours within 30 mins | Intestinal obstruction: 300 - 600 micrograms usual dose |
| Oxycodone Opioid 10mg/ml 1ml and 2ml Amps | Pain | Incompatible with cyclizine | Moderate hepatic impairment severe renal impairment concurrent MAOI or within 2 weeks | As per other opioids | One sixth of total 24h dose Within 5-10 mins | Titrate |

* 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

Dickman A. et al (2005) The Syringe Driver: *Continuous Subcutaneous Infusions in Palliative Care*. 2nd Edition Oxford: O.U.P.

Reviews

Scottish Intercollegiate Guidelines Network, (2000) *Control of Pain in Patients with cancer, a National Clinical Guideline*. Edinburgh: SIGN