Syringe Drivers

Subcutaneous (SC) drug infusion by portable syringe driver has had a significant impact on pain management\[1\]. It allows the continuous delivery of a range of therapies to aid patient comfort. It is most frequently used in palliative care (particularly cancer care), bypassing problems such as:

- Dysphagia.
- Inability to take medication orally.
- Weakness.

Pain is experienced by most patients with advanced cancer. Severe pain is experienced by 66% of people with cancer at some point in their illness\[2\].

- Sublingual administration is not always easy if the mouth is dry, co-ordination is poor or cognitive function is impaired.
- Rectal administration can be a challenge for carers, both physically and emotionally.
- A syringe driver is only an alternative method of administering medication. It does not produce more effective analgesia than the oral route unless the patient cannot use oral medication, or has serious compliance problems. It should not be routinely used as a ‘medical last rite’ if there is no specific indication for medication.

Other common indications for using a syringe driver in palliative care include the treatment of nausea and vomiting, excessive respiratory secretions, and agitation or restlessness.

Although GPs provide the majority of palliative care services in the UK, there are often problems with symptom control and communication. See separate Palliative Care, Looking after People with Cancer and End of Life Care articles.

Setting up the syringe driver

They are used primarily when patients are no longer able to take medicines by mouth. This may be because of persistent nausea, vomiting, dysphagia, weakness or coma. Local palliative care guidelines should always be followed when mixing drugs in a syringe driver:

- A syringe driver takes 3-4 hours to establish a steady state drug level in plasma. If the patient is in pain, vomiting or very agitated, give a stat SC injection of appropriate medication while setting up the syringe driver.
- Only use drugs that are known to be effective via the SC route. Diazepam, chlorpromazine and prochlorperazine are too irritant to be given SC.
- Check drug compatibility before mixing. If you are unable to discuss advice concerning drug combinations with either the palliative care team or the hospital drug information service, information can also be found at the palliative drugs website\[3\].
- Always use water for injection to dilute the drugs. Saline may be used if there are problems with site irritation. Saline should not be used with cyclizine, as it can cause precipitation.
- Calculate the total dose of drug required in 24 hours and then divide volume of solution by 24, to give a rate per hour.
- Never use solutions that have precipitated or become discoloured.
- Always consider alternative routes, such as buccal, rectal, sublingual or transdermal. The patient may not want a syringe driver.
## Drugs used in the syringe driver

<table>
<thead>
<tr>
<th>Drug and Indication</th>
<th>Dose</th>
<th>Other Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamorphine (for pain)</td>
<td>If the patient is not receiving oral morphine, 10-20 mg per 24 hours, or total oral dose in mg in last 24 hours divided by 3.</td>
<td>Prescribe one sixth of total 24-hour dose for breakthrough pain. Increase dose by one third if pain persists.</td>
</tr>
<tr>
<td>Hyoscine butylbromide (Buscopan®)</td>
<td>60-120 mg/24 hours.</td>
<td>Antispasmodic. Used in bowel spasm or ureteric colic.</td>
</tr>
<tr>
<td>Cyclizine (for vomiting)</td>
<td>75-150 mg/24 hours.</td>
<td>Used in vomiting associated with intestinal obstruction, raised intracranial pressure or hepatomegaly. May cause drowsiness and anticholinergic side-effects.</td>
</tr>
<tr>
<td>Haloperidol (for vomiting)</td>
<td>2.5-10 mg/24 hours.</td>
<td>For vomiting secondary to opiates, ureaemia, hypercalcaemia and intestinal obstruction. Is non-sedating. Rarely need more than 3 mg/24 hours.</td>
</tr>
<tr>
<td>Haloperidol (for terminal agitation/confusion)</td>
<td>10-30 mg/24 hours.</td>
<td>Used for confusion with evidence of hallucinations. Risk of dyskinesia above 10 mg/24 hours.</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>30-60 mg/24 hours.</td>
<td>Vomiting due to gastric stasis or compression.</td>
</tr>
<tr>
<td>Levomepromazine</td>
<td>6.25-100 mg/24 hours.</td>
<td>Second-line anti-emetic. Can be very sedating at higher doses.</td>
</tr>
<tr>
<td>Midazolam (for confusion)</td>
<td>20-100 mg/24 hours.</td>
<td>Confusion without hallucinations. Also used as anticonvulsant.</td>
</tr>
<tr>
<td>Hyoscine hydrobromide (scopolamine) (for confusion)</td>
<td>1.6-2.4 mg/24 hours.</td>
<td>Sedative and antispasmodic. Also anti-emetic.</td>
</tr>
<tr>
<td>Hyoscine hydrobromide (for excess respiratory secretions)</td>
<td>1.6-2.4 mg/24 hours.</td>
<td>Reduces secretions. May give paradoxical agitation in the elderly.</td>
</tr>
<tr>
<td>Glycopyrrolate (for excess respiratory secretions)</td>
<td>0.6-1.2 mg/24 hours.</td>
<td>0.2 mg stat dose. 2.5 times potency of hyoscine. No central side-effects.</td>
</tr>
</tbody>
</table>

### Drug compatibility

Generally there are few compatibility problems with common two and three drug combinations containing:

- Diamorphine
- Cyclizine
- Haloperidol
- Metoclopramide
- Levomepromazine
- Hyoscine hydrobromide
- Midazolam
However, there can be problems with:

- **Cyclizine** with diamorphine, once diamorphine dose exceeds 200 mg/24 hours. It causes precipitation with saline and with diamorphine doses exceeding 200 mg/24 hours. This can be solved by using water as diluent. At higher diamorphine doses, either put cyclizine in a second syringe driver or use levomepromazine as a single daily SC injection instead.
- **Hyoscine butyl bromide** (Buscopan®) is occasionally incompatible with cyclizine. Levomepromazine could be given as a single daily injection in place of cyclizine.
- **Ketorolac** has many incompatibilities. The main ones are with haloperidol, midazolam and cyclizine. Using a separate syringe driver is recommended.
- **Dexamethasone** has common/unpredictable precipitation. It also inactivates glycopyrrolate. This problem may be solved by using hyoscine hydrobromide instead of glycopyrrolate. Alternatively, dexamethasone could be given as a separate once-daily injection.

### Problems with syringe drivers

- Mechanical problems.
- Human errors [4].
- Reactions at the infusion site can be controlled by considering:
  - **Site:**
    - Daily change of site.
    - Placing a GTN patch over the site of the infusion.
  - **Needle:**
    - Needle should be bevel down.
    - Placing the needle intramuscularly (IM), rather than SC.
    - A small Teflon® cannula may be less irritating than a butterfly needle.
  - **Contents of infusion:**
    - Irritant drugs concentration may be too strong.
    - Consider whether irritant drugs can be substituted for non-irritant (eg, cyclizine to haloperidol).
    - Irritant drugs could be given by an alternative route - eg, PR or IM (levomepromazine can be given as a single daily injection).
    - Saline can be used for dilution instead of water (except for cyclizine).
    - Hyaluronidase (1,500 units) can be added to the infusion.
    - Dexamethasone can be added to the infusion, in a dose appropriate to the patient's clinical condition. (To add dexamethasone, the diamorphine should be made up with as much water as volume calculation allows. Other additions are then made. Dexamethasone is then drawn slowly into the syringe which is inverted a few times to mix.)
  - **Difficulties with mixing drugs within the syringe.**
  - **Errors in over-infusion:**
    - Fatalities have occurred.
    - If infusion is running too quickly or slowly, check rate calculation; if infusion is running too slowly, check start button, battery, syringe driver is in good working order, cannula for blockages and injection site for inflammation.

### Further reading & references

- Improving supportive and palliative care for adults with cancer; NICE Cancer Service Guideline, March 2004
- Gold Standards Framework
- General Palliative Care Guidelines for the Management of Pain at the End of Life in Adult Patients; Guidelines and Audit Implementation Network (February 2011)
- Palliative care for adults: strong opioids for pain relief; NICE Clinical Guideline (May 2012, updated 2016)
- Oxford Radcliffe syringe driver clinical protocol

2. Control of pain in adults with cancer; Scottish Intercollegiate Guidelines Network - SIGN (November 2008)
3. Palliativedrugs.com

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