

Syringe driver guidelines Graseby MS26 (mm/24h)

NHS Argyll & Clyde ACCORD Hospice Ardgowan Hospice St Vincent's Hospice

2005

Contents

Ba	kground and acknowledgements	2
Gra	seby syringe drivers	3
Inc	lications for syringe drivers and prescribing information	5
Dia	morphine dosing information	7
Bre	akthrough analgesia	8
Gu	idance on when to start the syringe driver	9
Set	ting up the MS26 syringe driver	
1	Equipment required	10
2	Filling the syringe	11
3	Setting the rate	15
4	Attaching and priming the line	16
5	Attaching the syringe to the driver	19
6	Choosing the site and inserting the line	20
7	Inserting the battery and starting the infusion	21
8	Documentation and monitoring	23
9	The boost button	26
10	Stopping the infusion and removing the syringe driver	27
Ad	verse incidents	28
Syr	inge driver problem solving	29
Ge	neral maintenance and servicing of equipment	31
Ha	zard and Safety Action Notices	32
Ap	pendices	
1	Drug information	33
2	Diamorphine compatibility and diluent for single drugs	35
3	Morphine guidance and compatibility	40
4	Sources of further advice	44
5	Palliative care model scheme network	46
No	tes	49



Syringe driver guidelines Graseby MS26 (mm/24h)

© NHS Argyll & Clyde 2005 Version 1 Implementation date 1/4/05 Review date 1/4/07 Project Lead Janet Trundle, Macmillan Specialist Pharmacist in Palliative Care Approved by Kate Lennon, Macmillan Nurse Consultant in Palliative Care Dr David Gray, Consultant in Palliative Medicine Dr David Morton, Chair, Area Drug & Therapeutics Committee

Background and acknowledgements

These guidelines supersede all previous local guidelines in primary care, acute and community hospitals, and hospices in Argyll & Clyde, and support the delivery of consistent, high quality best practice.

During the preparation of this document, there has been widespread consultation with practitioners across Argyll & Clyde using syringe drivers and those delivering training. Consensus was achieved on controversial points and changes in practice at a half day meeting in October 2004.

This guideline concentrates on safe use of the Graseby MS26 in palliative care, but it may be used to administer drugs in other circumstances and the same principles and guidance apply. Use by parenteral routes other than subcutaneous is outwith the scope of this guideline.

Acknowledgements

The contribution and co-operation of practitioners across all sectors of care in Argyll & Clyde in reaching a consensus on these guidelines, which reflect current best practice, is acknowledged. Particular thanks go to MaryAnn Boyd, Palliative Care Pharmacist, Royal Alexandra Hospital, Paisley, for her work in producing the earlier guideline from which this was adapted and, in conjunction with Mairi Rodger, Macmillan Palliative Care Clinical Nurse Specialist, developing the training package.

We are grateful for permission from NHS Lothian to use and adapt information from the Lothian Palliative Care Guidelines 2004. Thanks also to the West Lothian Healthcare Division for sharing their excellent MS26 syringe driver training pack.

Graseby syringe drivers

Graseby syringe drivers are portable, battery operated devices for delivering medications by continuous subcutaneous infusion when a patient is unable to take them orally, particularly within the palliative care setting.

Advantages include:

- acceptability and reliability
- reduced need for regular painful injections
- maintenance of patient mobility
- constant therapeutic drug levels
- only requires to be re-filled every 24 hours.

Disadvantages include:

- potential site of infection
- skin site reactions
- in emaciated patients or those on long term infusions, skin site availability may become an issue.

Types of Graseby syringe drivers

There are currently **two** types of Graseby syringe drivers, the MS16A and MS26. The main difference between them is the way the rate is set:

- The MS16A (blue front) is set in mm/hour
- The MS26 (green front) is set in mm/24hours.

Due to errors associated with the wrong rate setting being chosen, use of just one type of syringe driver is recommended. All areas in Argyll & Clyde now use only the MS26 for palliative care; the MS16A must **not** be used for palliative care.

There are still a few MS16As in Inverclyde Royal Hospital and a few other locations, and these are occasionally used for patients on drugs used by other specialties e.g. haematology. MS16As may also be in use in other NHS Board areas.

Practitioners should **not use the MS16A without appropriate training**, and seek appropriate local pharmaceutical advice **before** a patient using one is to be transferred to another setting.

Practice point Always check the model of syringe driver in use - an error can be fatal!

Each member of staff using a Graseby MS26 syringe driver should ideally have access to, and be familiar with, the manufacturer's instruction booklet. However, these are not now present with some of the MS26s in use, and some of the instructions in the booklet do not reflect our current best practice e.g. it describes how to use the boost button, which we do not advocate. The important points from the booklet are therefore included in this guideline.

Training

A comprehensive training package based on these guidelines is being developed for use across Argyll & Clyde. The principles behind the guidelines are discussed in detail, and linked to a practical workshop giving 'hands-on' experience of handling the equipment and preparing drug mixtures. Participants are expected to follow the training session with a period of personal study and supervised practice.

The aim of the training session is:

"To provide information to enable each participant to develop the skills to safely set up, monitor and maintain a continuous subcutaneous infusion using a Graseby MS26 whether in a hospital, a hospice or a community setting."

Training records should be maintained in each area for all staff who may use syringe drivers.

Practice point As with all medical devices, operation of the syringe driver should only be undertaken by, or under the supervision of, appropriately trained personnel.

Indications for syringe drivers and prescribing information

- 1 When oral route is not possible due to:
 - persistent nausea and vomiting
 - dysphagia
 - gastro-intestinal obstruction
 - severe weakness/unconsciousness.
- 2 Poor absorption by oral route (uncommon).
- 3 When patients would otherwise require regular injections.

The patient should give informed consent, if possible.

Syringe drivers will not give better analgesia than the oral route unless there is a problem with absorption or administration.

Many patients and relatives associate the use of syringe drivers with 'the end'. It is of vital importance to reassure them that they are purely an alternative means of delivering medication. A patient information leaflet which can be used to help explain their use is being developed and will be posted on: www.palliativecareargylland clyde.org.uk.

Prescribing information

All medicines given via the syringe driver should be clearly and correctly prescribed on the patient's drug prescription sheet. Where the prescription sheet used for syringe drivers is not the patient's main prescription sheet, the drugs prescribed must also be written on the main prescription (drug name and 'as charted' is sufficient), and any additional sheets with prescribing details must be referenced on the front page of the patient's main drug prescription sheet.

Also prescribe appropriate 'as required' medication to control breakthrough symptoms.

In addition to doctors, other prescribers may now prescribe in the palliative care setting:

- extended nurse prescribers (list of drugs in current BNF)
- supplementary nurse and pharmacist prescribers (in accordance with individual patient clinical management plan).

The following information must be written on the prescription sheet:

- patient name and date of birth and/or unit number/CHI number
- drug name (generic in CAPITALS)
- dose
- route (SC is acceptable)
- infusion period e.g. over 24 hours
- any known drug allergies
- prescriber's signature
- date.

Refer to Appendix 1 on page 33 for brief information on medicines commonly used in syringe drivers. Detailed guidance on drug choice, dose etc will be included in the Palliative Care Guidelines section of the Argyll & Clyde area-wide drug formulary (2005 version) and is available as a separate booklet and on www.palliativecareargyllandc lyde.org.uk

The nurse administering the medication should check (refer to Appendix 2 on page 35 and/or consult specialist palliative care team or pharmacist):

- stability of drug combination and hence which drugs are to be mixed in one driver
- diluent
- infusion volume required and hence syringe size.

In some cases, more than one driver may be required. Seek advice from pharmacist or specialist team if necessary.

Diamorphine dosing information

Diamorphine is the opioid of choice in syringe drivers due to its high solubility (it is fifteen times more soluble than morphine).

Note: At the time of print (March 2005), a shortage of diamorphine in the UK has necessitated use of subcutaneous morphine as an alternative. Refer to Appendix 3 on page 40 for interim guidance.

Patients who are not currently on any opioids

For a patient who has not previously been on any opioids, i.e. opioid naive, a suitable starting dose would be 5-10mg over 24 hours.

Patients already on oral morphine

When transferring from oral morphine the '3:1 rule' is a useful guide:

3mg oral morphine = 1mg subcutaneous diamorphine

Example 1

Patient on Sevredol 10mg five times a day total daily dose oral morphine = 50mg.

Subcutaneous diamorphine dose = 50/3 = 15mg/24hours.

Example 2

Make sure you add up the total of both the regular and breakthrough doses of morphine over a 24hour period.

Patient on MST 100mg twice daily and has had two 30mg breakthrough doses of Sevredol in last 24hours i.e. total daily dose oral morphine = 260mg.

Subcutaneous diamorphine dose = 260/3 = 80mg/24hours

Alternative opioids

For those patients who are on alternative opioids such as oxycodone, hydromorphone or fentanyl patches, please refer to the Argyll & Clyde Palliative Care Guidelines and/or seek advice from:

- a specialist palliative care practitioner e.g. specialist pharmacist or nurse, or palliative care doctor
- your local hospital pharmacy medicines information service, or out-of-hours on-call pharmacist (in-patients)
- a community pharmacy in the palliative care Model Scheme.

Refer to Appendix 4 (page 44) for details of sources of further advice.

GRASEBY MS26 SYRINGE DRIVER GUIDELINES

Breakthrough analgesia

All patients should be prescribed breakthrough diamorphine to have on an 'as required' basis. The dose should normally be approximately a 1/6th of their current 24hour diamorphine dose. The table below gives examples of typical scenarios:

Total dose (mg) of oral morphine in 24 hrs	Total dose (mg) of SC diamorphine in 24 hrs	Dose (mg) of SC diamorphine for breakthrough pain
30	10	2.5
60	20	2.5
90	30	5
120	40	5
150	50	10
180	60	10
240	80	15
300	100	20

Practice point Remember that when the 24hour dose is changed, the breakthrough dose should also be adjusted accordingly.

Caution: Breakthrough analgesia given for movement related pain or incident pain in a patient whose background pain is satisfactorily controlled should not normally be added into the regular 24hour dose as toxicity may ensue. Continue to give as breakthrough in anticipation of movement related pain.

Other options for administering breakthrough analgesia

A small butterfly or similar device may be inserted and left in situ for administering breakthrough doses, and in some cases, a carer can be trained to administer breakthrough doses via this.

Consider alternative drugs and routes e.g. morphine oral solution, morphine suppositories.

Guidance on when to start the syringe driver

Current regimen	When driver should be started	
Patient not currently on any opioid.	Start immediately	
Patient receiving opioid only on an 'as required' basis.	Start immediately	
Patient on normal release oral opioid preparation (e.g. Sevredol).	Start immediately	
Patient on modified release oral opioid preparation (e.g MST).	Ideally, start when next dose of modified release preparation due, but particularly in community, this may not be at a convenient time. Decision on an appropriate time should be based on the clinical status of each individual patient.	
Patient on fentanyl patch (End of Life).	Refer to Argyll & Clyde fentanyl guideline (www.palliativecareargyllandclyde.org.uk and summary in Argyll & Clyde Palliative Care Guidelines booklet) for details, or consult a pharmacist or palliative care specialist for advice.	

If the driver is started when the patient's pain is well controlled then a loading dose of diamorphine is not necessary.

Practice point If the patient's pain is not well controlled, give a breakthrough dose of diamorphine at the same time as starting the driver (recommended best practice SIGN Guideline 44). This should be approximately 1/6th of the 24hour dose prescribed in the syringe driver.

Setting up the MS26 syringe driver 1 Equipment required

- MS26 syringe driver + plastic cover
- 9V alkaline battery
- holster (for mobile patient)
- rate adjusting key, flat screwdriver or paper clip
- Luer lok syringe 10, 20 or 30ml
- subcutaneous infusion set
- antiseptic wipe
- transparent surgical dressing + surgical adhesive tape
- syringes and needles to prepare medication
- prescribed medicines + diluent
- prescription sheet + recording chart
- clean tray or surface for preparation.



Setting up the MS26 syringe driver 2 Filling the syringe

Set up of syringe driver only to be undertaken by, or under supervision of, appropriately trained personnel. Only 10, 20 or 30ml Luer lok syringes should be used. The maximum volumes which will fit in the syringe driver are about 9ml in 10ml syringe, 15ml in 20ml syringe and 20ml in 30ml syringe for BD Plastipak syringes. If another make is used, e.g. Terumo, the maximum volume may be different.

Practice point Check that the syringe you have selected will fit securely in the driver.

For one drug in the driver

- Establish what final volume is required in the syringe. It is not usually less than 8ml. Contact a pharmacist if you need advice.
- Select appropriate syringe size.
- Draw up the prescribed medication, and then add diluent (usually water for injection as less chance of precipitation, but refer to Appendix 2 on compatibility) to appropriate volume, draw a little air in to the syringe, invert it gently several times to mix, and then expel the air. (Take care not to expel any of the medication.)

Note: If the dose of diamorphine required is less than the full amount in an ampoule, you will need to measure accurately the amount of water used for reconstitution, and calculate the volume of solution to be taken out to give the required dose.

Example 1

If you add about 0.5ml water to a 100mg amp of diamorphine, and then make the solution up to 1.0ml, you will have a solution containing 100mg/ml diamorphine. If only 80mg is required, then 0.8ml should be withdrawn, with the remainder being discarded. One method of calculating this is:

Volume required (ml) = what you want (dose in mg) ÷ what you've got (dose in mg) x volume you've got (ml)

i.e. volume required = 80mg/100mg x 1.0ml = 0.8ml

Example 2

Once you have dissolved the diamorphine, make the volume up to a figure which makes it easy to calculate the volume to withdraw. If you wanted 20mg from a 30mg ampoule, it would be difficult to do this with 1.0ml as you need 2/3 of this. If you make the solution up to 3.0ml, the calculation is easy. i.e. volume required = 20mg/30mg x 3.0ml = 2ml

The same calculation applies to other drugs, but make sure you use consistent units (e.g. mg or microgram) throughout the calculation.

Example 3

A dose of 6.25mg levomepromazine has been prescribed. The ampoules are 25mg in 1ml. You need to calculate the volume of the injection to measure. Using the same formula as example 1:

Volume required (ml) = what you want (dose in mg) ÷ what you've got (dose in mg) x volume you've got (ml)

i.e. volume required = 6.25mg/25mg x 1.0ml = 0.25ml

Example 4

Metoclopramide 60mg by s/c infusion has been prescribed. The ampoules contain 10mg in 2ml.

Volume required (ml) = what you want (dose in mg) ÷ what you've got (dose in mg) x volume you've got (ml)

i.e. volume required = 60mg/10mg x 2.0ml = 12ml

You can use the same formula for doses in micrograms, but ensure you use micrograms for both what you want, **and** what you've got.

Mixing drugs in the syringe driver

There are various problems associated with the mixing of drugs. These include:

• Degradation of the drug(s) which can in turn lead to decreased efficacy. The rate of degradation may be increased by other drugs which alter the pH of the mixture. Direct sunlight and heat can also cause degradation of the drugs.

• Crystallisation/precipitation. This can occur through formation of an insoluble product of drug interaction, or because a drug alters the pH of the solution rendering a 2nd drug insoluble, or because of an interaction between drug and diluent.

Points to remember

Check compatibility charts (See Appendix 2 on page 35).

Consider factors affecting choice of final volume (drug concentration and hence stability and irritation at site).

Consider using an additional driver or an alternative route of drug administration.

Inspect the mixture at start and at the agreed monitoring frequency (section 8 below).

Monitor the patient for any signs of decreased efficacy.

For two drugs in the driver

Check compatibility charts! (See Appendix 2)

- Establish final volume required and select appropriate size of syringe.
- Reconstitute diamorphine (if prescribed) and draw into Luer lok syringe. Then, dilute to an appropriate volume (total volume less volume of second drug). If neither of drugs is diamorphine, follow same procedure with alternative opioid, if prescribed, or otherwise with one of prescribed drugs.
- Draw up second drug in to separate syringe of appropriate size and leave needle attached.
- Pull back plunger on first syringe to beyond final intended volume, and add second drug carefully through the Luer end.
- Invert syringe gently several times to mix the two drugs (there needs to be a little air in the syringe for this to be effective), then carefully expel the air, taking care not to expel any of the drug mixture.

For three drugs in the driver: Check compatibility charts! (See Appendix 2)

- This should be attempted only when evidence of stability exists, or on the advice of a palliative care specialist when other options, e.g. a second syringe driver, are not available or patient is cachectic with few available sites.
- Proceed in a similar manner to above, diluting 2 of the drugs as far as possible before adding the third.
- If dexamethasone or cyclizine are included in the mixture, add them last once the other 2 drugs are diluted as far as possible (because they are the commonest causes of incompatibility).

If any more than three drugs are required to be given, or the combination required is outwith those tabled in Appendix 2 on page 35, contact pharmacist or palliative care specialist for advice.

Practice point More than three drugs in the driver: this is not recommended practice in Argyll & Clyde. Seek advice of palliative care specialist on alternative options.

Labelling syringe

Complete a subcutaneous infusion label and then fix it to the syringe taking care not to obscure the length of solution in the syringe. The following details are required on the label:

- patient name
- CHI number
- drug name(s)
- dose of each drug
- diluent name
- total volume (ml)
- rate over 24hours (mm)
- date and time prepared.

Setting up the syringe driver 3 Setting the rate

Ensure that you are using the green MS26 24 hour syringe driver!



In Argyll & Clyde, subcutaneous infusions in palliative care settings using the MS26 are normally run over 24hours. If a different infusion period has been specified by the prescriber or the volume of drugs

to be infused over 24hours is too large to fit in syringe, consult pharmacist or specialist team for advice on how to proceed.

For infusion over 24hours:

Measure the length in millimetres of the fluid in the syringe using a clear ruler (not in ml!). This measurement is then used to



set the pump rate. Example: the fluid length measures 53mm. Therefore, the pump rate is set at 53mm/24 hours.

Graseby supply a small plastic device with the MS26 to adjust the rate setting dials.

Satisfactory alternatives are a small flat bladed screwdriver or paper clip; do not use scissors. Values from 0 to 99 can be set. Make sure that all of the number can be seen in each window.

Practice point Set the rate before priming the line!

Safety issues

The dimensions of different brands of syringe vary, and the length of solution **must** be measured each time a fresh syringe is prepared. **Never** assume that a certain volume = a certain length.

If the prescription is changed, you **must** prepare a new syringe and then follow the procedure above again. **Never** change the rate **nor** add an additional drug after the infusion has commenced.

Setting up the syringe driver 4 Attaching and priming the line

Only fine bore lines with a small priming volume (less than 1ml, and preferably less than 0.3ml) are recommended to minimise the effect of priming on the duration of the infusion time. The MiniMed MMT106 (formerly called Polyfin) is in widespread use in Argyll & Clyde and is currently recommended. It has a priming volume of 0.27ml. Extension sets, which generally have a 2-3ml priming volume, should **not** be used.

It is recommended that use of the Graseby 1ml Flo-Safer line is phased out in Argyll & Clyde because of the significant effect of the priming volume on infusion time.

New teflon cannula sets such as the MiniMed Silhouette (priming volume 0.15ml) are being piloted in several areas as an alternative.

There are 2 different situations which can occur:

- **A** A new infusion line is required because:
 - a line is not currently in situ, or
 - the existing line needs to be replaced, e.g. due to site problems or a change in prescription
- **B** A line is already in situ and can continue to be used.

A When a new infusion line is used

Practice point When a new skin site is needed, e.g. inflammation or pain, a fresh infusion set must be used.

Attach the infusion line to the syringe and ensure that the Luer lok is fully screwed on to the thread of the syringe tip.

Prime the infusion line:

- Prime tubing with syringe driver contents until the fluid just shows at the needle tip.
- Depending on the line used, up to 1ml is required for priming which means that the syringe driver will not run for the full 24hours. Measure the length of solution in mm now remaining in the syringe, and note this on the recording chart (if a fine

bore tube with a small priming volume is used, e.g. MMT106 (formerly called Polyfin), this will be almost the same as your original measurement). This measurement will allow you to work out how long the syringe driver will run for and establish if it will run out in less than 24 hours.

Changing line when prescription is changed

It is considered good practice to change the line and use a fresh site when there is a change in the medication prescribed. It will, however, also depend on the patient's condition. In cachectic patients and when a syringe driver has been in use over a long period, alternative sites may be very limited, and if the existing site is viable and the drugs not incompatible, continued use may be in the patient's best interest.

The need to change the line depends on:

- The priming volume of the line used and urgency of the change (due to the dead space in it and the time taken for the new solution to reach the subcutaneous site. When a Graseby line is used with a 10ml syringe, it will take about 3 hours for a change of prescription to reach the patient unless a new line is used and primed) – this is a clinical decision for each patient.
- The change in the prescription. When a different combination of drugs is initiated, a fresh line (and site) should be used (but see above). When the change is a discontinuation of a drug, or a change of dose, take account of the point above in deciding if a line change is needed.

Proceed as above 'when a new infusion line is used'.

B When an infusion line is already in situ in patient, and re-siting is not required

- Priming of the line is not required.
- Set the new rate on the driver.
- Disconnect the line from the previous syringe **before** removing the syringe from the driver (normally the syringe will be empty, but occasionally may not be, and this ensures that the patient does not receive an inadvertent bolus dose when the syringe is removed).

- Remove the previous syringe from the driver, and attach the new one to the driver as in section 5 below.
- Check that the infusion line is full of fluid and connect it to the new syringe ensuring that the Luer lok is fully screwed on to the thread of the syringe tip.

Setting up the syringe driver 5 Attaching the syringe to the driver

Practice point For safety reasons, the syringe **must** be attached to the driver **before** connecting to the patient – to avoid an inadvertent bolus dose.

Check the patient's name (and wristband if used) against the prescription, according to medication policy.



Attach the syringe to the driver, ensuring that the wing on the syringe fits into the deep slot in the case, and the syringe plunger into the slot in the actuator. Move the actuator by pressing the white button (see the diagram) so that it touches the syringe plunger (otherwise there will be a delay in the infusion starting).

Put the rubber securing strap in place over the syringe barrel, and hook and then press it into the groove on the side of the case.

Serious incidents have been reported involving uncontrolled flow of medication when the syringe has not been correctly or securely fitted to the syringe driver.

Practice point Ensure that the full length of the solution in the syringe is visible, and that drug details on label visible (even with small syringe, this is possible with care taken when applying label).

Setting up the syringe driver 6 Choosing the site and inserting the line

Where possible, involve the patient in the choice of a suitable site.

Both the outer arm and upper thigh are commonly used, but avoid the upper arm in bedbound patients who require frequent turning. In other patients, the chest or abdomen may be more suitable but avoid the chest wall in cachectic patients (danger of causing pneumothorax). The scapula may be considered for confused or delirious patients who pull on the line.

It is important to avoid:

- oedematous areas including lymphoedematous arms (poor drug absorption and increased risk of infection/exacerbation of oedema)
- bony prominences (poor absorption and discomfort)
- irradiated sites (may have poor perfusion and hence poor drug absorption)
- skin folds, sites near a joint and waistband area (movement may displace cannula; discomfort)
- broken skin.

Check the site regularly for signs of irritation. (See sections on monitoring, page 23, and problem solving, page 29.)

Insert a butterfly or MMT106 (formerly called Polyfin) needle at an angle of 30 to 45 degrees into subcutaneous tissue. Do not bend the needle during insertion. Loop the tube to reduce the risk of the needle being pulled out and secure with transparent adhesive dressing, e.g. Tegaderm.

Alternative newer sets may have a different insertion angle and integral securing dressing.

Setting up the syringe driver

7 Inserting the battery and starting the infusion

Note that the syringe driver has no stop button.

The only safe way to stop it is by removing the battery (except that when the infusion is complete and the syringe is empty, it will stop automatically and the alarm will sound for about 15 seconds). If the infusion is to be stopped before the syringe is empty, it should also be disconnected from the patient for safety reasons. A syringe that is not empty must never be taken off the driver while connected to the patient.

Always use an alkaline 9V battery. These can be identified by the international code 6LR61 on the battery or packaging. Duracell MN1604 is recommended, as some brands may be slightly larger and not fit properly.

Insert the battery making sure it is connected the right way round, and close the battery compartment. An audible **alarm** will sound for about 15 seconds. This is the same noise that occurs when:

- the infusion has ended
- the line is blocked
- the start/boost button is depressed for 10 seconds.

Press and hold down the **start** button to test the safety systems. You will hear the motor and it will stop after 10 seconds. When the alarm sounds, release the button to silence the alarm and start the driver. Do not use the driver if the motor does not stop and/or the alarm does not sound.

The **light** on the front of the driver should now start to flash every 25 seconds. If it does not, replace the battery. If, during the infusion, the light stops flashing then the battery is almost depleted. The manufacturer states that the remaining contents will still be delivered, but it is recommended that the battery be changed as soon as this happens.

A fresh battery should be able to deliver 50 daily infusions.

Practice point Check that the correct rate has been set before sliding the plastic cover on.

Slide the driver into the clear plastic protective cover, until the **start** button lines up with the hole in the cover. The peg on the inside back of the cover goes into the hole in the back of the driver, hold-ing the cover in place.

Practice point It is important to ensure that the cover is placed the correct way round as, if it is placed the wrong way round, the nodule at the back can press on the start/boost button resulting in the infusion running at the wrong rate and causing over dosage.

The syringe driver may be placed in a shoulder holster (with the syringe nozzle uppermost) or 'bumbag' if patient is ambulant. Take care infusion line not trapped anywhere.

If the patient is lying in bed, do not place the syringe driver much higher than the infusion site e.g. on bedside locker, to reduce the risk of syphonage – **serious incidents involving syphonage have been reported**.

Shield the syringe and line from light as drugs may deteriorate, particularly in direct sunlight.

Setting up the syringe driver

8 Documentation and monitoring

Record details of preparation and commencement of infusion on recording chart.

All measurements are in millimetres (mm).

Record:

- date
- time
- total volume (ml) drugs + diluent
- fluid length in syringe in mm (before priming line)
- rate setting (mm per 24hours)
- drug name(s) and batch number(s)
- diluent name and batch number
- medical physics reference number on syringe driver
- signature(s) of person(s) preparing and checking.

Practice point Note that after commencement of the infusion, all measurements of solution length in the syringe must be made with an independent ruler (easiest with a clear one); the syringe must **not** be removed from the driver to check against the scale on the front of it.

The operation of the driver should be checked:

- within one hour of set up (e.g. in community, just before leaving patient's house) and then
- 4 hourly in hospital and hospice settings
- at each visit by a nurse in primary care settings the frequency of this will depend on factors such as other nursing needs of patient, willingness or ability of patient/carer to assist in monitoring, risk of instability of drug mixture

and documented on the recording chart.

Practice point In the community, the patient and/or carer must be instructed on what to do, and who to contact, if a problem arises.

- Record the date and time of check.
- Record the rate setting, and check that it is correct.
- Measure in mm the length of solution remaining in the syringe, and calculate the distance travelled since previous check to assess whether syringe is delivering medication at approximately the desired rate.
- Check the solution in the syringe and the line for cloudiness, precipitation or colour change, and presence of large air bubbles (tiny ones not significant).
- Check that battery light flashing.
- Check that line securely attached to syringe and not leaking, and line not kinked or trapped.
- Check infusion site for:
 - redness
 - swelling
 - discomfort/pain
 - leakage of fluid.
- Record location of infusion site when syringe set up and when line is changed (reduces disturbance to patient when monitoring).
- When site is changed, record reason.

The result of these checks should be documented on the recording chart, and signed by person checking.

If any checks are **not** carried out, e.g. site check to prevent disturbing patient when asleep, record this and the reason.

Use the comments section to record e.g. new line primed, site reaction/site change, colour change or cloudiness of solution.

Practice point If any checks indicate a problem, e.g. the infusion is not running at the expected rate, you **must** take appropriate action. The section on problem solving (page 29) may assist.

Assess patient for efficacy and side-effects of the medication, and seek advice from the appropriate team member if needed.

If an infusion is discontinued before it is complete e.g. because of a change in dose or drug, document the amount remaining and destroyed (mm and ml) on the recording chart.

Action points after monitoring checks

Action **must** be taken, and documented, in the event of:

- significant discrepancies in the actual and expected infusion rate
- signs of incompatibility
- blockage of infusion line
- damage to syringe barrel or tip, or presence of large amount of air (may indicate cracked syringe barrel)
- site reaction.

For details of actions to take, refer to adverse incidents (page 28) and problem solving (page 29).

Setting up the syringe driver 9 The boost button

The MS26 driver has a boost button. The boost button is **not** to be used in patients in ArgyII & Clyde for several reasons:

- The dose of analgesic delivered by the boost is wholly inadequate in relation to recommended breakthrough pain dose (i.e. it is not a sixth of the total daily dose).
- Drugs other than analgesics are often present in the driver and a bolus of these may not be required at the same time.
- The delivery of a bolus may cause pain at the injection site.
- The boost facility lacks a lock out period. If the boost button is continually depressed, the MS26 will deliver 8 boluses before an alarm sounds and no further boosts are delivered. There is the potential for the entire syringe to be delivered in this way.

Setting up the syringe driver

10 Stopping the infusion and removing the syringe driver

- Removal of cannula and/or discontinuation of infusion to be carried out only by appropriately trained personnel.
- When the infusion is complete and the syringe is empty, it will stop automatically and the alarm will sound for about 15 seconds. The indicator lamp will stop flashing.
- If syringe driver no longer required for patient remove battery from syringe driver.
- If the infusion is to be stopped before the syringe is empty, it should also be disconnected from the patient for safety reasons. A syringe that is not empty must never be taken off the driver while connected to the patient.

Practice point Note that the MS26 syringe driver has no stop button – the only safe way to stop it is by removing the battery.

 Clean driver and cover as detailed under General maintenance on page 31 (do **not** immerse driver in water), dry and replace in packaging if no longer required for use, together with a copy of these guidelines.

What to do if patient dies when syringe driver is running

- Stop the driver by removing the battery and remove the needle/ cannula as soon as possible.
- Record on the monitoring chart the date, time and amount of solution remaining in the syringe (mm and ml) and destroyed and the signature(s) of person present and witness (if there is one).

Adverse incidents

Any adverse incidents involving syringe drivers such as incorrect rate settings should be reported to the senior nurse on duty or on-call and medical staff immediately. Follow local reporting system for medication/medical device incidents. See problem solving section (next page) for potential problems and solutions.

When significant under or over infusion has occurred, stop the infusion, and, after consultation with prescriber, prepare a fresh syringe if appropriate.

If it is suspected that the equipment has malfunctioned, or a serious incident has occurred, the syringe and infusion line should remain attached to the syringe driver, for inspection by Medical Physics. A different syringe driver should be obtained and used for the patient.

Syringe driver problem solving

Won't start

- Check battery not inserted, wrong way round, exhausted (light not flashing).
- Start button not depressed firmly enough for a few seconds.

Light stops flashing

• Low battery – the manufacturer states that the remaining contents will still be delivered, but it is recommended that the battery be changed as soon as possible.

Alarm sounding – indicating that plunger cannot move (note that also sounds when battery inserted, infusion ends and start button held down for 10 seconds).

- Line may be blocked check for precipitation.
- Check if line trapped or twisted.

Infusion too slow or stopped

- Check site for inflammation and swelling.
- Check tubing for kink or stretching.
- Check connections intact.
- Check moveable actuator is still against plunger.
- Check rate setting and calculations.
- Light still flashing and faint click heard plunger mechanism worn out send to Medical Physics.

Infusion too fast

- If major over-infusion, stop infusion, check condition of patient and seek medical advice. Report as a medication incident.
- Check rate setting and calculations.
- Check for disconnection of line or needle.
- Check syringe securely attached to driver.
- Check no air present in syringe (solution will syphon in if barrel cracked).
- Check plastic cover on correct way round and nodule not pressing on boost button.
- Ask patient/carer if they have pressed the boost button or removed plastic cover.
- If syringe driver could be faulty, send to Medical Physics with full information on incident.

Site irritation

- Change site (use a new infusion set when changing site).
- Discuss possible change of drugs with doctor (cyclizine and levomepromazine = most common cause).
- Dilute drugs to a larger volume in a new syringe.
- Consider separating into 2 syringe drivers.
- Try teflon set if nickel allergy e.g. Silhouette.
- Consider infection.
- Change route of drugs e.g. rectal.
- For severe site reactions which persist despite usual measures such as increased dilution of drug(s), consult palliative care specialist for advice on treatment options or the use of hyaluronidase or steroid.

Precipitation, cloudiness or colour change in syringe contents or line

Stop infusion and inform prescriber. Issues to check and discuss with prescriber include:

- Compatibility information.
- Diluent (seek advice from a pharmacist as to when saline might be appropriate).
- Dilute to a larger volume.
- Consider separating into 2 syringe drivers or give one drug as a subcutaneous bolus.
- Keep away from sunlight and heat.
- Advise patient on keeping syringe driver away from hot pack/ heat pad or hot water bottle.

Commence new infusion at different site with new infusion line.

General maintenance and servicing of equipment

Cleansing should be done with a damp disposable cloth (use warm water and general purpose detergent). Dry thoroughly.

If any additional cleansing needed, e.g. the threads of the screw the actuator moves along, contact infection control team for advice.

The driver must not be submersed in water (and if it is accidentally dropped into water, it must be withdrawn from use immediately and sent to Medical Physics).

In order to ensure they maintain their function, syringe drivers should be serviced every 12 months by Medical Physics. If your ward/area/team keeps syringe drivers, follow local procedure for management of infusion devices.

Hazard and Safety Action Notices

There should be a local procedure in place to ensure that NHS Scotland Hazard and Safety Action Notices, issued by the Scottish Executive Health Department, are disseminated to users and appropriate and timely action taken and documented.

Examples of Hazard and Safety Action Notices

- **1995** A Graseby Syringe Driver was placed the wrong way round within the plastic cover. As a result, the infusion was delivered at an inappropriate rate because the stud inside the rear of the cover depressed the Start button.
- **1996** In spite of earlier warnings, incidents still reported of confusion between MS16A and MS26 syringe drivers. One resulted in a fatality due to over-infusion.

Appendix 1 Drug information

The table below shows some information for those medicines that are commonly used in syringe drivers. (Adapted from Lothian Palliative Care Guidelines 2004.)

Drug name	Strength available
Indications and dose	Comments
Cyclizine	50mg in 1ml
Nausea and vomiting due to intestinal obstruction or intracranial disease	Can cause redness and irritation around subcutaneous site Anticholinergic side effects
50-150mg/24 hours	Incompatible with sodium chloride 0.9%
Dexamethasone sodium phosphate	e 4mg in 1ml, 5mg in 1ml, 8mg/2ml, 10mg/2ml
Intractable nausea and vomiting or raised intracranial pressure 2-16mg/24 hours	SC dexamethasone should be prescribed as dexamethasone sodium phosphate When changing from oral to SC, the same dose of dexamethasone as used orally is given as dexamethasone sodium phosphate subcutaneously Insomnia occurs at higher doses
	Consider giving dexamethasone as a once or twice daily SC bolus injection
Diamorphine hydrochloride	5mg, 10mg, 30mg, 100mg, 500mg ampoules
Opioid responsive pain when the oral route is not available Dose information: page 7	Incompatible with sodium chloride 0.9% at doses > 40mg/ml
Diclofenac 75ma in	
Bone pain/inflammation when other routes not available 75-150mg/24 hours	Initiated under supervision of palliative medicine specialist Gastrointestinal and renal toxicity
Haloperidol	5mg in 1ml, 10mg in 2ml
Opioid or metabolic induced nausea, delirium 2.5-10mg/24 hours	Extrapyramidal side effects at higher doses and in chronic use Antipsychotic Long half life Can be given as SC bolus injection once daily Incompatible with sodium chloride 0.9%

Hyoscine butylbromide	20mg in 1ml
Intestinal obstruction	Non-sedative anticholinergic
(colic, vomiting)	Reduces intestinal colic and peristalsis
40-120mg/24 hours	Some antisecretory effect in gastrointestinal tract
Hyoscine hydrobromide	400 micrograms in 1ml, 600 micrograms in 1ml
For airway secretions	Sedative anticholinergic
1200-1800 micrograms/	Can cause agitation and confusion
24 hours	A single bolus dose may be sufficient – see Argyll & Clyde Palliative Care Guidelines for dose
Ketorolac	10mg in 1ml, 30mg in 1ml
Bone pain/inflammation when other routes not avail-	Initiated under supervision of palliative medicine specialist
able: 10-30mg/24 hours	Gastrointestinal and renal toxicity
Levomepromazine	25mg in 1ml
Antiemetic dose: 6.25-25mg/24 hours	Sedating at higher doses, reduces blood pres- sure: use low doses
Terminal restlessness dose:	Long acting: can give SC once or twice daily
25-100mg/24 hours	Protect syringe and line from sunlight
	Reduces seizure threshold
Metoclopramide	Reduces seizure threshold 10mg in 2ml
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours)
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclopure 5, 20mg/24	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours)
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Anticonvulsant (20-30mg/24 hours)
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours for heavy sedation	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Anticonvulsant (20-30mg/24 hours)
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours for heavy sedation Octreotide	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Anticonvulsant (20-30mg/24 hours) 100micrograms in 1ml, 500micrograms in 1ml
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours for heavy sedation Octreotide Intractable vomiting due to	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Anticonvulsant (20-30mg/24 hours) 100micrograms in 1ml, 500micrograms in 1ml Potent antisecretory agent in Gl tract
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours for heavy sedation Octreotide Intractable vomiting due to intestinal obstruction, fistula discharge	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Anticonvulsant (20-30mg/24 hours) 100micrograms in 1ml, 500micrograms in 1ml Potent antisecretory agent in Gl tract Does not treat nausea
Metoclopramide Nausea and vomiting espe- cially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours for heavy sedation Octreotide Intractable vomiting due to intestinal obstruction, fistula discharge 300 – 900 micrograms/	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Muscle relaxant (20-30mg/24 hours) 100micrograms in 1ml, 500micrograms in 1ml Potent antisecretory agent in Gl tract Does not treat nausea Try antiemetics & hyoscine butylbromide first
Metoclopramide Nausea and vomiting especially due to gastric stasis/ outlet obstruction, opioid induced nausea 40-80mg/24 hours Midazolam Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours for heavy sedation Octreotide Intractable vomiting due to intestinal obstruction, fistula discharge 300 – 900 micrograms/ 24 hours	Reduces seizure threshold 10mg in 2ml Prokinetic Avoid if complete intestinal obstruction sus- pected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose 10mg in 2ml Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Anticonvulsant (20-30mg/24 hours) 100micrograms in 1ml, 500micrograms in 1ml Potent antisecretory agent in Gl tract Does not treat nausea Try antiemetics & hyoscine butylbromide first Third line; high cost

Refer also to chapter on *Prescribing in Palliative Care* in current BNF, and for detailed information to Argyll & Clyde Palliative Care Guidelines 2005, available on www.palliativecareargyllandclyde.org.uk.

Appendix 2 Diamorphine compatibility and diluent for single drugs

This appendix contains 4 tables relating to drug dilution and the compatibility of drug mixtures:

Table 1 Single drugs which should be mixed with a diluent otherthan water.

Table 2 Combinations which are not stable: give separately or con-sider alternative drugs or routes.

Table 3 Two drug combinations for subcutaneous infusion whichare stable for 24 hours.

Table 4 Three drug combinations for subcutaneous infusion whichare stable for 24 hours.

How to interpret the information

Diluent

Water for injection is generally the diluent of choice except for the drugs listed in Table 1 when given on their own (when mixed with other drugs, water for injection will normally be the diluent).

Note that cyclizine and haloperidol must not be diluted with sodium chloride (incompatible).

The information in Tables 3 and 4 is adapted from the data in SIGN guideline 44 'Control of pain in patients with cancer'. These combinations have been chemically tested in a laboratory and are known to be stable for at least 24hours at amounts equal to or below those stated.

Combinations and doses outwith those listed in these tables should be used only on the recommendation of a palliative care specialist, or on the advice of a pharmacist. The advice given should be documented clearly in the patient's notes. Evidence for the chemical stability of other combinations may not be available, but physical stability data in some of the literature may be used to inform choice of combinations. This data usually comes from observations made in clinical practice, often in specialist palliative care units, and is reported as combinations which appear to be physically stable in that:

- they do not change colour or precipitate and
- appear to be clinically effective.

Good practice points

Site reactions and the risk of incompatibility may be minimised by increasing the volume of diluent.

Always check for signs of incompatibility: precipitation, cloudiness, colour change.

Protect drug solution in syringe from direct sunlight.

Prepare a fresh syringe just before the driver is set up, and do not run for more than 24hours.

Sources of advice

Sources of advice on single drugs or combinations of drugs which practitioners are unfamiliar with include the following:

- Macmillan Specialist Pharmacist for Palliative Care
- Hospital Palliative Care Pharmacists at RAH and IRH, and aseptic services pharmacist at VOL
- Hospital pharmacy medicine information departments at RAH, IRH, VOL and Lorn & Islands DGH
- Palliative Care Model Scheme Community Pharmacists (list of participating pharmacies in Appendix 5, and on www.palliativecareargyllandclyde.org.uk)
- On call hospital pharmacists (for in-patients)
- Specialist Palliative Care Units and Consultants.

The best reference source at present is The Syringe Driver¹.

It is strongly recommended that practitioners seek advice for drugs and combinations with which they are not familiar.

Table 1 Single drugs which should be mixed with a diluent other than water

Drug	Recommended diluent
Diclofenac (used on specialist advice	Sodium chloride 0.9%. Do not mix
only)	with other drugs.
Ketamine (for specialist use only)	Sodium chloride 0.9% or dextrose 5%.
Ketorolac (used on specialist advice	Sodium chloride 0.9% or dextrose
only)	5%. Normally given on its own
	due to pH of injection and risk of
	incompatibility.
Levomepromazine	Sodium chloride 0.9%
Octreotide	Sodium chloride 0.9%.

Table 2 Combinations which are not stable²: give separately or consider alternative drugs or routes

Diamorphine, cyclizine and metoclopramide Diamorphine, dexamethasone and levomepromazine Diamorphine, dexamethasone and midazolam Diamorphine, metoclopramide and ondansetron Octreotide and levomepromazine Octreotide and cyclizine Octreotide and dexamethasone Dexamethasone and haloperidol¹ (although stable at some doses with diamorphine – see Table 4)

Table 3 **Two** drug combinations for subcutaneous infusion which are stable for 24 hours³ in water for injection

Note: figures in this table are not clinical doses

Some figures are in excess of normal clinical doses. Refer to drug information table (page 33-34) and Argyll & Clyde Palliative Care Guidelines for dosage information.

Stable combinations at doses (mg)
less than, or equal to, those in table

Drug combination	9ml in a 10ml syringe	15ml in a	20ml in a 30ml svringe
Diamorphine	180	300	400
and Cyclizine	150) 150	150
Diamorphine	450) 750	1000
and Dexamethasone	3.6	5 6	8
Can pr	ecipitate if undiluted	l drugs are mixed d	uring preparation
Diamorphine	900 450) .	
and Haloperidol	27 36) ·	
	If exceed thes	e doses then likely	to get precipitate
Diamorphine	1350) .	
and Hyoscine Hydrobromide	3.6		
· · ·	(3600microgram)	
Diamorphine	1350) .	
and Hyoscine Butylbromide	180)	
(Buscopan)			
Diamorphine	52	2 87	105
and Ketorolac	45	5 79	105
		For use on spe	cialist advice only
Diamorphine	450) 750	1000
and Levomepromazine	90) 150	200
	Mixture can be irrite	ant, dilute to larges	t possible volume
Diamorphine	1350) 2250	3000
and Metoclopramide	45	5 75	100
	Mixture can be irrite	ant, dilute to larges	t possible volume
Diamorphine	450) 750	1000
and Midazolam	18	30	40
Diamorphine	225	5 375	500
and Octreotide	1.0) 1.7	2.2
	(1000microgram) (1700microgram)	(2200microgram)

Table 4 **Three** drug combinations for subcutaneous infusion which are stable for 24 hours³ in water for injection

Note: figures in this table are not clinical doses

Some figures are in excess of normal clinical doses. Refer to drug information table (page 33-34) and Argyll & Clyde Palliative Care Guidelines for dosage information.

Stable combinations at doses (mg) less than, or equal to, those in table

Drug combination	9ml in a 10ml syringe	15ml in a 20ml syringe	20ml in a 30ml syringe
Diamorphine	180	300	400
and Cyclizine	150	150	150
and Haloperidol	18	30	40
Diamorphine	450	750	1000
and Dexamethasone	3.6	6	8
and Haloperidol	9	15	20

Only stable if diamorphine and haloperidol are well diluted before dexamethasone is added. Use only if no other options.

		/ /	1
Diamorphine	450	750	1000
and Dexamethasone	3.6	6	8
and Metoclopramide	27	45	60
Diamorphine	630	1050	1400
and Haloperidol	4	7	10
and Midazolam	36	60	80
Diamorphine	450	750	1000
and Levomepromazine	90	150	200
and Metoclopramide	27	45	60

References

1 The Syringe Driver, A Dickman, C Littlewood, J Varga. Oxford University Press 2003.

(Note: 2nd edition being published March 2005 ISBN 0-19-856693-X.)

- 2 Annex 9 (page 51) SIGN 44 The Control of Pain in Patients with Cancer.
- 3 Adapted from Annex 9 SIGN 44 The Control of Pain in Patients with Cancer.

Appendix 3 Morphine guidance and compatibility

This **interim guidance** is extracted from a bulletin issued to practitioners in Argyll & Clyde in January 2005, and remains in force at the time of print while the diamorphine supply problems continue. The full guidance and any updates issued will be posted on www.palliativecareargyllandclyde.org.uk.

Summary

- The diamorphine supply situation may be uncertain for a while.
- **Morphine sulphate injection** is the first choice alternative to subcutaneous (sc) diamorphine.

To convert from oral to subcutaneous morphine, divide the total 24hour dose of oral morphine by 2, e.g. 60mg oral morphine/24hours = 30mg subcutaneous morphine/24hours.

If conversion from subcutaneous diamorphine is required, multiply 24hour dose of sc diamorphine by 1.5, e.g. 10mg subcutaneous diamorphine/24hours = 15mg subcutaneous morphine/24hours.

Breakthrough dose of subcutaneous morphine = one sixth of 24hour dose of subcutaneous morphine.

- Other alternatives e.g. oxycodone or alfentanil should only be used on specialist advice
- Seek advice or reassurance from specialist practitioners if you are unsure or unfamiliar with alternative opioids.

Choice of alternative opioid

- Where supplies permit, continue to use subcutaneous (sc) diamorphine for patients already stabilised on it. Only use for new patients if you are reasonably certain that there are sufficient supplies available locally for the likely duration of treatment.
- For other new patients requiring a sc opioid, either for breakthrough or by infusion (or patients already on diamorphine if further supplies cannot be obtained), use **morphine sulphate injection** as first choice.
- **Oxycodone** injection should be reserved for patients with unacceptable side effects or toxicity on diamorphine and morphine. Oxycodone injection is a new preparation, we have very limited experience of use and there is considerable debate over conversion ratios with other opioids.
- Conserve stocks of the **high strength** ampoules of diamorphine for use when alternative opioids such as morphine or oxycodone are impractical to give by syringe driver due to the large volumes which would be required i.e. when high doses are needed.
- Alfentanil is likely to be the most suitable alternative to diamorphine for patients requiring high doses of a sc opioid. Advice from palliative care specialists on dose, titration etc must be sought. Care is needed with the 2 different strengths available, and because it is much more potent than diamorphine.
- Fentanyl transdermal patch is appropriate only for stable pain. It is not suitable for titrating analgesia in unstable pain, and not likely to be a suitable alternative to diamorphine for most patients. Remember that the lowest strength patch (25microgram/ hour) is equivalent to about 90mg/24hours of oral morphine.
- For patients already on a fentanyl patch who have increasing pain at end of life, sc morphine by bolus injection for breakthrough or as a continuous infusion may be **added** in addition to continuing the fentanyl patch the same guidance as for diamorphine (see page 9 for sources of guidance) will give a suitable starting dose (which may be a little low, but can be titrated).

Drug preparation and compatibility

- All opioids other than diamorphine are supplied as liquids, and the **volume** of the prescribed dose needs to be considered. 20ml is the maximum which will fit into the largest size of syringe (30ml) in the Graseby MS26 syringe driver. When larger volumes are required, the options advised are to run 2 syringe drivers concurrently over 24hours, give the opioid in a separate syringe driver to the other drugs, or consider a change to a more potent opioid (seek advice from specialists).
- For **breakthrough** analgesia, a 1ml volume is about the maximum which can comfortably be given subcutaneously at one site. Consider if there is a higher strength of the preparation you are using, and consider alternative routes e.g. can the patient take Oramorph or use morphine suppositories?
- Compatibility information currently available for **morphine** lacks chemical stability and concentration data, but it is widely used in syringe drivers in other countries (tables on next page).

Good practice points

Careful and regular monitoring of efficacy and toxicity is required for all changes in opioid or route of administration as equipotent doses vary between patients.

Practitioners who do not have experience of using alternative opioids should seek advice or reassurance from palliative care practitioners as required.

In primary care, GPs and district nurses are advised to check in advance at the time of prescribing with the patient's normal community pharmacy (or one of the Model Scheme pharmacies holding palliative care stock) that the intended drug is available in the form and strength required, as Controlled Drug prescriptions must specify the exact preparation to be dispensed.

The community pharmacies in the Palliative Care Model Scheme (Appendix 5 on page 46) will stock alternative preparations as advised by the Macmillan Pharmacist.

Compatibility information for morphine sulphate mixtures¹: stable for 24hours in water for injection

There is little information on doses or volumes used in these mixtures; infusions should be monitored closely for signs of incompatibility e.g. cloudiness, colour change.

Drug	Compatibility
Metoclopramide	Visually compatible
Haloperidol	Visually compatible
Cyclizine	Visually compatible
Levomepromazine (Nozinan®)	Visually compatible
Hyoscine hydrobromide	Chemical data for hyoscine. Morphine not chemically tested
Hyoscine butylbromide	Chemical data
(Buscopan®)	
Midazolam	Visually compatible
Octreotide	Visually compatible

Table 1: Compatibility for morphine sulphate: two drug mixtures

Table 2: Compatibility for morphine sulphate: three drug mixtures¹

Drugs	Compatibility
Haloperidol & metoclopramide	Visually compatible
Cyclizine & metoclopramide	Visually compatible
Cyclizine & haloperidol	Visually compatible
Hyoscine hydrobromide & haloperidol	Visually compatible
Midazolam & metoclopramide	Visually compatible
Midazolam & haloperidol	Visually compatible
Midazolam & cyclizine	Visually compatible
Octreotide & haloperidol	Visually compatible
Midazolam & hyoscine hydrobromide	Compatibility based on clinical experience

1 Adapted from: Auckland District Health Board Department of Pharmacy 'Compatibility of syringe driver admixtures for continuous subcutaneous infusion 2002'.

Appendix 4 Sources of further advice

First points of contact will often be your local colleagues, including:

Primary Care

- Community Nurses
- Gold Standards Framework lead GP and nurse
- Macmillan GP facilitator
- Macmillan Clinical Nurse Specialist
- Community Pharmacy Model Scheme Network (which can be accessed via patient's normal community pharmacy) – list of participating pharmacies in Appendix 5.

Acute Hospitals

- Macmillan Clinical Nurse Specialists
- Palliative Care Clinical Pharmacists
- Hospital Pharmacy Medicines Information Pharmacists
- On-call pharmacists
- Consultant medical staff
- Specialist Palliative Care Teams.

Note your local contact details here:

Advice is also available across Argyll & Clyde from specialist practitioners:

Specialist Palliative Care Teams including specialist nurses	Medical Consultant/ Clinical Lead
ACCORD Hospice Hawkhead Road Paisley 0141 581 2000	Dr Wendy Baxter Dr David Gray
Ardgowan Hospice Nelson Street Greenock 01475 726830	(vacancy)
St Vincent's Hospice Midton Road Howwood By Johnstone 01505 705635	Dr Roz Beattie
Beatson Palliative Care Team For Lomond & Argyll area 'out-of-hours' Glasgow 0141 211 2411	Prof John Welsh
Palliative Care Team Royal Alexandra Hospital Paisley 0141 887 9111 (switchboard)	Dr David Gray
Macmillan Specialist Pharmacist in Palliative Care 0141 314 4177 or 0788 078 6659	Janet Trundle
Macmillan Nurse Consultant in Palliative Care 07771 674373	Kate Lennon

Appendix 5 Palliative care model scheme network

Pharmacies holding palliative care medicines

The pharmacies below keep an agreed stock of specialist medicines, which may be required urgently by patients receiving palliative care, especially those on syringe drivers. Contact with these pharmacies may be made either through the patient's usual community pharmacy, or directly. Telephone numbers are pharmacy contact details.

Out of hours procedure when pharmacies are not open

- Each pharmacy except at present Boots and ASDA has agreed that a pharmacist will come out if contacted at home for the urgent supply of medication.
- Prescriptions required out-of-hours should be marked 'urgent' by the prescriber.
- If no pharmacy in the appropriate area is open, professionals can contact the Primary Care out-of-hours 'hub' at the Vale of Leven Hospital and explain that palliative care medicines are required urgently. This number should not be issued to patients.
- A member of staff at the 'hub' will take details of the request and will phone the pharmacists on the list until they find one who is available. The pharmacist will then contact the original caller to arrange supply.
- The pharmacists' home phone numbers will **not** be given to callers.

For safety reasons the nature of the medicines held is confidential. The pharmacists' home contact details are for use only by the healthcare team, and must not be given to members of the public.

Pharmacy details	Opening hours	Opening hours	
Lomond & Argyll			
Moss Chemist	Mon – Fri	9.00 - 18.00	
12/14 Mitchell Way	Sat	9.00 - 17.00	
Alexandria G83 OLW	Sun (Rota)	11.00 - 12.00	
01389 752012			
Moss Pharmacy,	Mon/Tues/Thurs/Fri	9.00 - 17.30	
19 Main Street,	Wed	9.00 - 13.00	
Campbeltown PA28 6AD	Sat	9.00 - 17.00	
01586 553208			

Dalmally Pharmacy,	Mon/Tues/Thurs/Fri	9.00 - 17.30
Main Road,	Wed	9.00 - 13.00
Dalmally PA33 1AX	Sat	9.00 - 13.00
01838 200465		
John Kemp Pharmacy	Mon/Tues/Thurs/Fri	9.00 - 17.45
8 High Street	Wed	9.00 - 17.30
Dumbarton G82 1LL	Sat	9.00 - 17.00
01389 762598	Sun (Rota)	11.00 - 12.00
James Marshall Pharmacy	Mon – Sat	9.00 – 17.30
67, Argyll St	Every 4th Sun	12.00 - 13.00
Dunoon, Argyll PA23 7HG		
01369 702157		
Moss Chemist	Mon – Fri	9.00 - 18.00
52A Sinclair Street	Sat	9.00 – 17.30
Helensburgh G84 8SR	Sun (Rota)	11.00 - 12.00
01436 672823		
J W McNulty,	Mon/Wed/Thurs/Fri	9.00 - 13.00
1 Main Street,		
Inveraray PA31 8TU		
01499 302133		
Moss Chemist	Mon/Wed/Thurs/Fri	9.00 – 13.00 &
Argyll Buildings		14.00 – 17.30
Kilcreggan G84 0JH	Tues & Sat	9.00 - 13.00
01436 842457		
Argyll Pharmacies Ltd,	Mon – Fri	9.00 – 17.30
12/14 Argyll Street,	Sat	10.00 - 17.00
Lochgilphead PA31 8LZ		
01546 603217		
Boots Chemist,	Mon – Sat	8.45 – 17.30
34/38 George Street,		
Oban PA34 5NL		
01631 562517		
Marchbanks	Mon – Fri	9.00 – 17.30
117 Main Street	Sat	9.00 – 13.00
Renton, Dumbarton G82 NL	Sun (Rota)	11.00 – 12.00
01389752914		
Lloyds Pharmacy,	Mon – Sat	9.00 – 17.30
1 Victoria Street,		
Rothesay PA20 0AJ		
01700 502836		
Tarbert Pharmacy	Mon – Fri	9.00 – 17.30
Bannockburn Building	Sat	9.00 – 17.00
larbert PA2961W		
01880 820232		

Pharmacy details	Opening hours	
Renfrewshire and Inverclyde		
Fraser Pharmacy	Mon – Fri	9.00 - 18.00
152/4 Main Street	Sat	9.00 - 13.00
Barrhead G78 1SG		
0141 881 1750		
Andrew Hughes Chemist	Mon – Fri	9.00 - 18.00
Unit 4 Bridgewater Centre	Sat	9.00 - 17:30
Erskine PA8 7AA		
0141 812 0112		
Pettigrews Pharmacy	Mon/Tues/Thurs/Fri	9.00 - 17.30
38 Cardwell Road,	Wed	9.00 - 17.00
Gourock PA19 1UH	Sat	9.00 - 17.30
01475 632028		
Tesco Pharmacy	Mon – Sat	8.00 - 21.00
2 Dalrymple Street,	Sun	10.00 - 18.00
Greenock PA15 1LE		
01475 497449		
The Village Pharmacy	Mon – Fri	8.30 - 17.30
Houston Medical Centre, Kirk Road,	Sat	9.00 - 12.30
Houston PA6 7AR		
01505 614739		
Penmans Pharmacy	Mon/Wed/Thurs/Fri	9.00 - 17:30
41 High Street	Tue, Sat	9.00 - 17.00
Johnstone PA5 8AJ		
01505 320116		
ASDA Pharmacy	Mon – Fri	8:30 - 21.00
Phoenix Retail Park,	Sat	8.00 - 21.00
Linwood PA3 3BA	Sun	9.00 - 18.00
0141 842 8520		
Abbey Chemist	Mon – Fri	9.00 - 18.00
27 Gauze Street	Sat	9.00 - 17:30
Paisley PA1 1ES		
0141 889 3377		
Boots Chemist	Mon – Fri	9.45 - 21.00
Unit MSU3, Braehead Shopping Centre,	Sat	9.00 - 18.30
Renfrew PA4 8WE	Sun	10.00 - 18.00
0141 885 9099		
F A Parkinsons (Chemist) Ltd	Mon – Wed	9.00 - 17.30
4 High Street,	Thur – Fri	9.00 - 17.45
Renfrew PA4 8QR	Sat	9.00 - 17.00
0141 886 2085		

For queries with regards to this publication and to request further copies, please contact:

Janet Trundle Macmillan Specialist Pharmacist in Palliative Care NHS Argyll & Clyde Old Trust Headquarters Dykebar Hospital Grahamston Road Paisley PA2 7DE

 Tel:
 (0141) 314 4177/4171

 Fax:
 (0141) 314 4256

 Email:
 janet.trundle@renver-pct.scot.nhs.uk