NHS Highland

NHS Greater Glasgow and Clyde

Syringe pump guidelines

CME McKinley T34 (ml/hour)

For use within Argyll and Bute CHP and Clyde

ACCORD Hospice
Ardgowan Hospice
St Vincent's Hospice

2007

Contents

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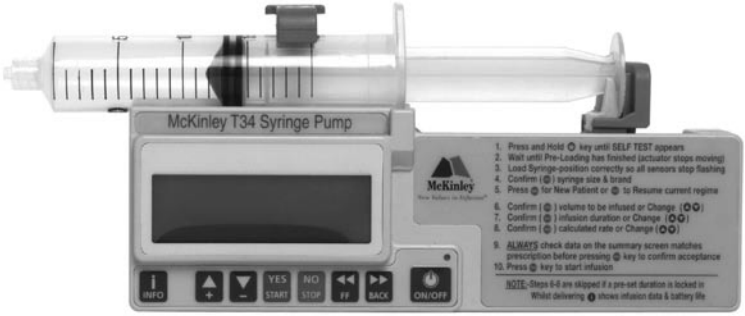

 Version 2

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Background and acknowledgements

Background

These guidelines have been produced following extensive consultation with practitioners from all areas to support the delivery of consistent, high quality care through best practice. They are intended for all clinical settings throughout Argyll and Bute CHP and Clyde (acute and community hospitals, primary care and hospices) and supersede NHS Argyll and Clyde *Syringe driver guidelines Graseby MS26*.

This guideline concentrates on safe use of the McKinley T34 syringe pump in palliative care. It may be used to administer drugs in other circumstances but these, as well as the use by parenteral routes other than subcutaneous, are outwith the scope of this guideline.

Acknowledgements

The contribution and co-operation of practitioners across all care sectors in Argyll and Bute CHP and Clyde in reaching a consensus is acknowledged. We gratefully acknowledge permission from NHS Highland and the Greater Glasgow area of NHS Greater Glasgow and Clyde to use and adapt their guidelines. Particular thanks go to Stephanie Hutchinson in co-ordinating the McKinley T34 syringe pump changeover.

Significant changes to the 2005 syringe driver guidelines

- 20ml syringe recommended as minimum size (page 11).
- Rate setting for the McKinley T34 is in **ml/hour**.
- Priming of the infusion line **before** the syringe is attached to the T34 pump and the rate set (page 17).
- New section on what to do if the pump needs to be temporarily stopped during the infusion (page 27).
- During infusion monitoring checks, the **total** volume infused is checked and documented, not the volume since the last check (page 23).
- Additional community pharmacies stocking palliative care medicines (see Appendix 6).
- Changes in tables of drug compatibility for combinations which are stable/not stable (see Appendix 2).
- Use of mobile phone in close proximity to infusion pumps (page 33).

McKinley T34 syringe pump

The McKinley T34 syringe pump is a portable, battery operated device for delivering medications by continuous subcutaneous infusion. Syringe pumps are a useful way of delivering medication when a patient is unable to take oral medication. They are of particular use in palliative care.

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.

McKinley syringe pumps

From September 2007, the McKinley syringe pump will be the only device used to deliver palliative care medicines in Argyll and Bute CHP and Clyde. After this date, all Graseby MS26 and MS16 must be returned to Medical Physics. Each pump has been allocated an individual number and will be programmed with the locations that the pump has been allocated to by Medical Physics. Staff should not borrow pumps from other areas. A system should be set up in each area to monitor the location of syringe pumps.

The McKinley T34 is calibrated in ml per hour. The standard delivery period for a continuous subcutaneous infusion in palliative care is 24 hours.

Training

Before setting up or using the McKinley T34 syringe pump, staff must familiarise themselves with the manufacturer's instruction booklet. A training package on the use of subcutaneous infusions in palliative care utilising the McKinley T34 will be available from August 2007.

The training sessions aim to provide participants from all settings with the knowledge to develop the skills to set up, monitor and maintain continuous subcutaneous infusions using the McKinley T34 syringe pump.

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.

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

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

Indications for syringe pumps 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.

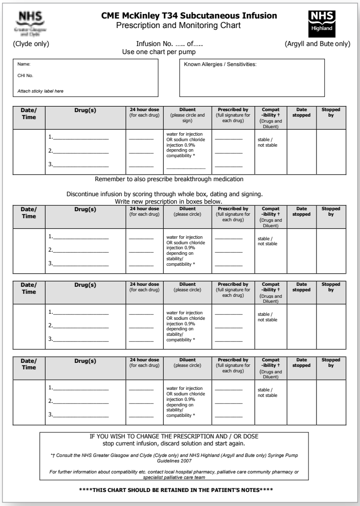
The patient should give informed consent, if possible.

Syringe pumps will not deliver a better analgesic effect than the oral route unless there is a problem with absorption or administration.

Many patients and relatives associate the use of syringe pumps with 'the end of life'. 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.palliativecareargyllandclyde.org.uk.

Prescribing information

All medicines given via the syringe pump should be clearly and correctly prescribed on the patient's McKinley T34 Subcutaneous Infusion Prescription and Monitoring Chart. The drugs prescribed must also be written on the patient's prescription form (drug name and 'as charted' is sufficient). The McKinley T34 chart with prescribing details must be referenced on the front page of the patient's main drug prescription.



CME McKinley T34 Subcutaneous Infusion
Prescription and Monitoring Chart

(Clyde only) | Infusion No. ..... of..... | (Argyll and Bute only)

Use one chart per pump

Name:
CHI No.
Attach sticky label here

Known Allergies / Sensitivities:

Date/ Time	Drug(s)	24 hour dose (for each drug)	Diluent (please circle and sign)	Prescribed by (full signature for each drug)	Compat -ibility † (Drugs and Diluent)	Date stopped	Stopped by
	1.____ 2.____ 3.____	____ ____ ____	water for injection OR sodium chloride injection 0.9% depending on compatibility * ____	____ ____ ____	stable / not stable		

Remember to also prescribe breakthrough medication

Discontinue infusion by scoring through whole box, dating and signing.
Write new prescription in boxes below.

Date/ Time	Drug(s)	24 hour dose (for each drug)	Diluent (please circle)	Prescribed by (full signature for each drug)	Compat -ibility † (Drugs and Diluent)	Date stopped	Stopped by
	1.____ 2.____ 3.____	____ ____ ____	water for injection OR sodium chloride injection 0.9% depending on stability/ compatibility *	____ ____ ____	stable / not stable		

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	1.____ 2.____ 3.____	____ ____ ____	water for injection OR sodium chloride injection 0.9% depending on stability/ compatibility *	____ ____ ____	stable / not stable		

IF YOU WISH TO CHANGE THE PRESCRIPTION AND / OR DOSE
stop current infusion, discard solution and start again.

**† Consult the NHS Greater Glasgow and Clyde (Clyde only) and NHS Highland (Argyll and Bute only) Syringe Pump Guidelines 2007*

For further information about compatibility etc. contact local hospital pharmacy, palliative care community pharmacy or specialist palliative care team

******THIS CHART SHOULD BE RETAINED IN THE PATIENT'S NOTES******

Practice point **Remember to prescribe appropriate 'as required' medication to control breakthrough symptoms.**

In addition to doctors, some other prescribers including nurses and pharmacists may now prescribe in the palliative care setting.

The following information must be written on the McKinley T34 Subcutaneous Infusion Prescription and Monitoring Chart:

- patient name and CHI number
- any known allergies
- date and time
- drug name (generic in CAPITALS)
- dose over 24 hours
- prescriber's signature.

Refer to Appendix 1 on page 35 for brief information on medicines commonly used in syringe pumps. Detailed guidance on drug choice, dose etc can be located in local palliative care guidelines or by contacting specialist palliative care teams.

The person preparing the medication should check the following (refer to Appendix 2 on page 38 and/or consult specialist palliative care team or pharmacist):

- drug prescription
- compatibility of drugs prescribed
- diluent
- infusion volume required
- size of syringe required.

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

Diamorphine dosing information

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

Note: At the time of print (September 2007), the ongoing shortage of diamorphine in the UK has necessitated the use of subcutaneous morphine as an alternative. Refer to Appendix 3 on page 44 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

Caution: If the patient has had multiple breakthrough doses over the last 24 hours, after careful assessment, consider adding less than their total breakthrough morphine to the syringe driver. Very large increases in dose can lead to opioid toxicity. See palliative care guideline or seek specialist advice for further information.

Practice point **Always assess the patient's pain and look for symptoms and signs of opioid toxicity when changing opioid doses or route of administration. Ensure the patient is regularly reassessed for poorly controlled pain and opioid toxicity when on a syringe driver.**

Alternative opioids

For those patients who are on alternative opioids such as oxycodone, hydromorphone or fentanyl patches, please refer to the local 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 network.

Refer to Appendix 5 (page 49) for sources of further advice.

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 incident 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 select 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 pump

Current regimen	When pump should be started
Patient not currently on any opioid.	Start immediately
Patient receiving opioid only on an 'as required' basis.	Start immediately
Patient on immediate 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 local palliative care guidelines for details, or consult a pharmacist or palliative care specialist for advice.

If the pump 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 pump (recommended best practice SIGN Guideline 44). This should be approximately 1/6th of the 24hour dose prescribed in the syringe pump.**

If oral treatment is to be re-started when should the continuous subcutaneous infusion be stopped ?

If an oral modified release preparation is being commenced, the continuous subcutaneous infusion should be stopped when the first dose of modified release oral opioid is administered. The patient may require breakthrough medication more frequently until therapeutic levels are reached. If further advice is required, seek guidance from a palliative care specialist.

Setting up the McKinley T34 syringe pump

1 Equipment required

- T34 syringe pump and plastic lockbox and key
- 9V alkaline battery (recommended Duracell MN1604)
- holster (for mobile patient)
- Luer lok syringe 20 or 30ml (recommended BD Plastipak)
- subcutaneous infusion set
- antiseptic wipe
- transparent surgical dressing
- syringes and needles to prepare medication
- prescribed medicines + diluent
- McKinley T34 Subcutaneous Infusion Prescription And Monitoring Chart
- clean tray or surface for preparation.

Setting up the McKinley T34 syringe pump
2 Filling the syringe

N.B. The McKinley T34 is calibrated in ml per hour. The standard delivery period for a continuous subcutaneous infusion in palliative care is 24 hours.

As stated on page 4, the setting up of the syringe pump is to be undertaken only by, or under the supervision of, appropriately trained personnel. It is recommended that only 20ml or 30ml Luer lok Becton Dickinson (BD) Plastipak syringes are used. The McKinley T34 can hold larger syringes, the largest being 50ml, however the lockbox currently supplied with the pump can only hold up to 30ml syringes. If a larger syringe is required, contact the palliative care team for further advice. The maximum volumes, which will fit in the pumps, are about 17ml in 20ml syringe and 22ml in 30ml syringe for BD Plastipak syringes. If another make is used the maximum volume may be different, refer to Appendix 4 on page 48.

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

For one drug in the pump

- Establish what final volume is required in the syringe. It is considered good practice to make the solution as dilute as possible to reduce the likelihood of drug incompatibility and minimise site irritation. Refer to compatibility tables (Appendix 2) for recommended volumes. Contact a pharmacist if you need advice.
- Select appropriate size of syringe.
- 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 into 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 solution after 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 pump

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 38).

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

If in doubt about compatibility/stability of drug combination, consider using an additional pump or an alternative route of administration.

Inspect the drug mixture before starting the infusion and at each subsequent check (section 7 below).

Monitor the patient for any signs of decreased drug efficacy.

For two drugs in the pump

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 the drugs is diamorphine, follow same procedure with alternative opioid, if prescribed, or otherwise with one of prescribed drugs.
- Draw up second drug into a 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 pump:

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 pump, 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 38, contact pharmacist or palliative care specialist for advice.

Practice point **More than three drugs in the pump: this is not recommended practice in Argyll and Bute CHP and Clyde. Seek advice of palliative care specialist for alternative options.**

Labelling syringe

Complete a subcutaneous infusion pink label, attach it to a clear flag label, then wrap the flag round the barrel of the syringe. Ensure that the flag is placed close to the tip of the syringe to avoid interference with the barrel arm sensor. The following details are required on the label:

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

Practice point **If the prescription is changed, you must prepare a new syringe. Never add an additional drug after the infusion has commenced.**

Setting up the McKinley T34 syringe pump
3 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 dose administered. The MiniMed MMT106 (formerly called Polyfin) has a priming volume of 0.27ml and is currently in widespread use in Argyll and Bute CHP and Clyde.

Teflon cannula sets (e.g. MiniMed Silhouette priming volume 0.15ml) are particularly suitable for use with cachetic patients or where a metal allergy exists.

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 tubing with syringe pump contents until the fluid just shows at the needle tip.
- If a new line is required part way through an infusion (e.g. due to site irritation) it will require priming which means that the syringe pump will not run for the full 24hours.

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. The need to change the line depends on the change in the prescription. When a different drugs combination is initiated, a fresh line should ideally be used. When the change is a discontinuation of a drug, or a change of dose, take account of the point below in deciding if a line change is needed.

A change of line will also depend on the patient's condition. In cachectic patients and when a syringe pump has been in use over a long period, alternative sites may be very limited. If the existing site is viable and the drugs not incompatible, continued use may be in the patient's best interest.

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

- Disconnect the line from the previous syringe **before** removing the syringe from the pump (normally the syringe will be empty, but occasionally may not be. This ensures that the patient does not receive an inadvertent bolus dose when the syringe is removed).
- Remove the previous syringe from the pump, and attach the new one to the pump as in section 4 below.
- Check that the infusion line is full of fluid. Connect it to the new syringe ensuring that the Luer lok is fully screwed on to the thread of the syringe tip.
- Program the infusion on the pump.
- If there is any delay in re-attaching the syringe to the line, a sterile universal bung may be used to cap the line.

Practice point **A new infusion line is required when the site needs to be changed due to a site reaction, e.g. redness, pain, swelling. Refer to problem solving suggestions to resolve site irritation on page 32.**

Setting up the McKinley T34 syringe pump
4 Pre-loading and syringe placement

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

Pre-loading

- Draw up prescribed medication.
- Install the battery into the McKinley T34 pump.
- Before placing the syringe into the pump, ensure the barrel clamp arm is down then press and hold the **ON/OFF** key until the 'pump identification' screen appears. The identification screen briefly shows the pump model, software version and the location of the pump set by Medical Physics.
- The LCD display will indicate 'Pre-Loading' and the actuator will start to move. Wait until it stops moving and the syringe sensor detection screen (syringe graphic) appears.

Practice point **Always check the battery power before starting the infusion. Press the INFO key repeatedly until the battery level option appears on the screen and then press YES to confirm.**

The average battery life, starting at 100%, is approximately 3-4 days depending on use. If the battery power is less than 40% life remaining at the start of the infusion, discard the battery and install a new one.

Always use a 9 volt battery. The recommended battery is the Duracell MN1604. Other brands can be slightly larger and may not fit the pump properly.

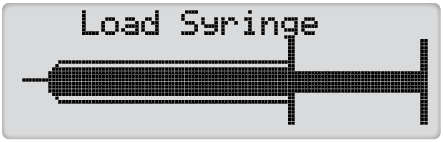
Connect a new infusion set (if used) to the syringe

If a new infusion set is being used, connect it securely to the syringe and manually prime the line.

Syringe placement

- If the actuator is not in the correct position to accommodate the syringe, leave the barrel clamp arm down and use the **FF** or **BACK** buttons on the keypad to move the actuator. Forward movement of the actuator is limited therefore repeated presses of the **FF** key may be required when moving the actuator, backwards movement is not restricted.

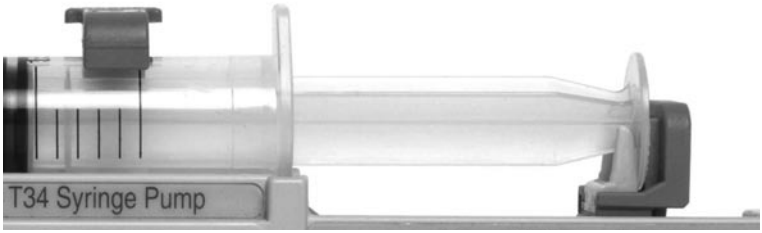
During pre-loading the actuator always returns to the start position of the last infusion programmed.



Fitting the syringe to the syringe pump

Warning! To avoid an inadvertent bolus dose, the syringe must be attached to the pump before connecting to the patient.

- Check the patient's name (and wristband if used) against the prescription, according to medication policy.
- Lift the barrel clamp arm and seat the filled syringe collar/ear and plunger so the back of the collar/ear sits in central slot (ensure correct placement). The syringe collar/ear should be vertical. Ensure that the scale on the syringe barrel is facing forward.
- Click syringe plunger into actuator. This may require some pressure.
- Lower the barrel clamp arm. The syringe graphic on the screen ceases to flash when the syringe is correctly seated at all 3 points.



Practice point **Ensure that the drug details are on a label and that the label hangs over the back of the pump so that it does not obscure the screen.**

The syringe size and brand option will then be displayed as shown below.

- If the syringe size and brand match the screen message, press **YES** key to confirm. If syringe size and/or brand do not match, scroll with up and down arrows until the correct selection appears, then press **YES** key to confirm.

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

5 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. Avoid the chest wall in cachectic patients (danger of causing pneumothorax). The scapula may be considered for confused or delirious patients who may pull on the line.

The following sites should be avoided:

- 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 30.)

Insert an 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 infusion lines may have a different insertion angle and integral securing dressing.

6 Starting the infusion (new syringe)

- After confirming syringe type, the next screen that appears is displayed below.

Example figures only

- The pump calculates and displays the total volume, duration of infusion (24 hrs) and rate of infusion (ml per hour) – Press **YES** to confirm or **ON/OFF** to return to the syringe options.
- Pump screen prompts:

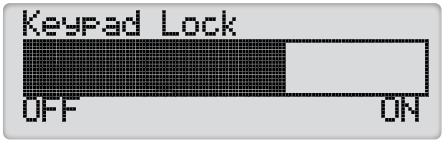
- Check the line is connected to the pump and patient.
- Press **YES** to start infusion.
- When the pump is running, the green LED indicator flashes and the screen displays:

Example figures only

Practice point **If the infusion has not been started and a button has not been pressed for more than two minutes, an alarm will sound. The message 'Pump Paused Too Long' 'Confirm, Press YES' will show on the LCD display. To stop the alarm, press YES and continue programming the infusion.**

Keypad lock

The McKinley T34 syringe pump allows users to lock the operation of the keypad during infusion. This function should be routinely used to prevent tampering with the device. To activate the keypad lock, press and hold the **INFO** key until a chart is displayed showing a 'progress' bar moving from left to right. Hold the key until the bar has moved completely across the screen and a beep is heard to confirm the lock has been activated.



Practice point **Although the keypad lock is on the following buttons are still active: NO/STOP, YES/START, and INFO.**

To deactivate the keypad lock (pump must be infusing) repeat the above procedure. The bar will now move from right (lock on) to left (lock off) and a beep will be heard.

Every McKinley T34 syringe pump will be supplied with a lockbox. After starting the infusion, check that the syringe pump is set correctly and place the pump in the supplied lockbox. Universal keys will be supplied to each ward area/community nurse. Replacement keys, if required, are the responsibility of individual teams. If a key is lost, complete an incident report form.

Warning – To reduce the risk of syphonage, the syringe pump should be placed at the same level as, or lower than, the infusion site.

7 Documentation and monitoring

Record details of preparation and commencement of infusion on 'daily set up' section of the McKinley T34 Subcutaneous Infusion Prescription and Monitoring Chart.

All measurements are in **millilitres (ml)**.

Record list:

- Medical Physics asset number on syringe pump
- date and time
- flow rate in ml per hour
- battery percentage
- diluent name and batch number
- drug name(s) and batch number(s)
- total volume (ml) drugs + diluent
- site used and appearance
- syringe appearance
- signature(s) of person(s) preparing and checking.

Practice point **Note that after commencement of the infusion, all measurements of solution volume in the syringe must be accessed through the INFO button.**

The operation of the pump should be checked:

- within one hour of set up (or, 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.

The following data should be documented on the McKinley T34 Subcutaneous Infusion Prescription and Monitoring Chart, as follows:

- Record the time of check.
- Check infusion site for:
  - redness
  - swelling
  - discomfort/pain
  - leakage of fluid.

- 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).
- Record the flow rate, and check that it is correct.
- Record the solution volume to be infused and the volume infused to assess whether the syringe is delivering medication at approximately the desired rate.
- Check that the battery light is flashing. There is no need to record the battery percentage as this has been done as part of the daily set-up.
- 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 in 'Notes' section.

The result of these checks should be documented on the monitoring 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.

Although not listed as a check on the monitoring chart, it is considered best practice at each check to inspect the line to ensure that it is securely attached to both the syringe and the patient and that the line is not leaking, kinked or trapped. If there are any problems, then they must be documented on the monitoring 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.**

Use the 'Notes' 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 and document this in the 'Notes' section. The section on problem solving (page 30) may assist.**

Assess patient for efficacy and side-effects of the medication. 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 of solution remaining and destroyed (ml) on the monitoring chart.

Action points after monitoring checks

Action **must** be taken, and documented in the 'Notes' section, 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 29) and Problem solving (page 30).

8 Stopping the infusion and removing the syringe pump

Practice point **Removal of cannula and/or discontinuation of infusion to be carried out only by appropriately trained personnel.**

- When the infusion is nearing completion, a warning will be shown on the LCD display 15 minutes before the end of the infusion. When the infusion is complete and the syringe is empty, the pump will stop automatically and an alarm will sound.
- If the syringe pump is no longer required for the patient, press **YES** to confirm the end of the infusion, disable the keypad lock and press and hold the **ON/OFF** to switch off the pump.
- 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 pump while connected to the patient. If the infusion is to be stopped before the syringe is empty, disconnect the pump from the patient before removing the syringe from the pump.
- Clean the pump and lockbox as detailed under General maintenance on page 33 (do **not** immerse pump 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 pump is running

- Stop the pump by pressing the **STOP** button and remove the needle/cannula as soon as possible. Switch off the pump by disabling the keypad lock and then press and hold the **ON/OFF** button.
- Record on the McKinley T34 chart the date, time and amount of solution remaining in the syringe (ml) and destroyed. The signature(s) of person present and witness (if there is one).

How to temporarily stop the infusion

This is not normal practice and should only be used in exceptional circumstances (this should not be used for priming a second line).

- Press **STOP**, disable the keypad lock and press and hold the **ON**/**OFF** button.
- Do **not** remove the syringe from the pump.

What to do if the infusion is interrupted

- To resume the infusion, check that the prescription, syringe label and patient details match, to ensure that this is the correct syringe for this patient.
- Press and hold the **ON** button until a beep is heard.
- The screen will request confirmation of syringe size and syringe brand.

If the syringe size and brand match the screen message, press **YES** key to confirm. If syringe size and/or brand do not match, scroll with up and down arrows until the correct selection appears, then press **YES** key to confirm.

The screen will display:

- Press **YES** to resume the previous program: the screen will display 'volume, duration and rate'. Press **YES** to confirm and the screen will display 'Start Infusion', press **YES** to confirm.

Warning – If you press NO, the pump interprets this as a completely new 24hour period and the remaining contents of the syringe would be delivered over the next 24 hours from confirming 'Start Infusion'. The patient would not therefore receive the prescribed dose. If NO has been pressed in error, discard the remainder of the syringe contents, and prepare and set up a new syringe.

How to stop the pump and prime a new line after the infusion has started

- Press **STOP**, disable the keypack lock. **Do not** switch off the pump.
- Disconnect the existing line from the syringe and remove the line from the patient.
- Remove the syringe from the pump. Attach and prime the new line.
- Resize the actuator and place the syringe in the pump.
- Confirm the syringe make and size.
- Insert the new line to a new site (as per page 20).
- Press **YES** to resume the previous program: the screen will display 'volume, duration and rate'. Press **YES** to confirm and the screen will display 'Start Infusion', press **YES** to confirm.

The time remaining for the infusion will decrease to compensate for the solution that was used priming the second line, the flow rate will remain the same.

Adverse incidents

Any adverse incidents involving syringe pumps, such as apparent over or under infusion, should be reported to the senior nurse on duty or on-call 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 pump, for inspection by Medical Physics. A different syringe pump should be obtained and used for the patient. An incident form should be completed at the earliest opportunity.

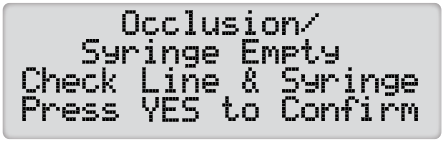
Syringe pump problem solving

Syringe pump alarm conditions

When the pump detects a problem, the following occurs:

- an audible alarm is activated
- the infusion stops
- display indicates the nature of the problem
- the LED indicator turns red.

The alarm will sound for one of the following reasons:

Possible cause	Action
	
Patient cannula/line blocked, kinked.	Remove occlusion and restart as per page 27.
Occlusion.	Occlusion due to drug precipitation: refer to page 32.
Infusion has finished.	End of program, switch pump off.
	
Syringe has been removed or displaced.	Check and confirm syringe seated correctly in the pump and resume infusion. Syringe flanges need to be in the vertical position at all times.
	
No key presses detected for 2 minutes.	Start infusion, continue programming or switch off.

Possible cause	Action
	**Intermittent bleep**
15 minutes from end of infusion	Prepare to change syringe or switch off
	**Intermittent bleep**
Infusion complete	Pump will alarm. Press YES to confirm end of program and OFF to switch off pump.
	
Battery is almost depleted (30 minutes left)	Prepare to change battery and resume infusion.
	
Battery is depleted	Change battery and resume infusion.

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 for accuracy.
- If any concerns about operation of pump, refer to Medical Physics.

Infusion too fast

- **If major over-infusion occurs, stop infusion, check condition of patient and seek medical advice.** Report as a medication incident.
- Check rate setting for accuracy.
- Check for disconnection of line or needle.
- Check syringe securely attached to pump.
- Check no air present in syringe (solution will syphon in if barrel cracked).
- If syringe pump could be faulty, send to Medical Physics with full information on incident, leaving syringe and infusion line in situ on pump.

Site irritation

- Change site (use a new infusion set when changing site).
- Discuss possible change of drugs with doctor/pharmacist (cyclizine and levomepromazine = most common cause).
- Dilute drugs to a larger volume in a new syringe for the next infusion.
- Consider separating into 2 syringe pumps for the next infusion.
- 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.

Precipitation, cloudiness or colour change in syringe contents or line

Stop infusion and inform prescriber. Issues to check and discuss with pharmacist or 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 pumps or give one drug as a subcutaneous bolus.
- Keep away from sunlight and heat.
- Advise patient on keeping syringe pump 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

The pump must not be immersed in water. The pump and lockbox should be cleaned with a detergent wipe and dried thoroughly.

If the pump is accidentally dropped into water, it must be withdrawn from use immediately and sent to Medical Physics.

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

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

Patients should be aware that there is a small risk of mobile phones interfering with the McKinley T34 syringe pump. To reduce this risk, patients and carers should only use a mobile phone within 2 metres of the pump if absolutely necessary and the phone must remain switched off unless in use. If the patient requires to use the phone, it should be held in the opposite hand from the side where the syringe pump is placed.

Medical Physics can be contacted at the following locations:

- RAH: 0141 314 6637
- IRH: 01475 504560
- VOL: 01389 817249
- Oban: 01631 788939

Hazard and Safety Action Notices

NHS Greater Glasgow and Clyde, NHS Highland and the hospices operate a cascade system for hazard warning notification. Individuals with responsibility for managing areas where syringe pumps are in use must ensure relevant notices are acted, and reported, upon.

Appendix 1
Drug information

The table below shows some information for those medicines that are commonly used in syringe pumps. (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 50-150mg/24 hours	Can cause redness and irritation around subcutaneous site Anticholinergic side effects Incompatible with sodium chloride 0.9%
Dexamethasone	*4mg in 1ml, 8mg in 2ml*
Intractable nausea and vomiting or raised intracranial pressure 2-16mg/24 hours	SC dexamethasone should be prescribed as dexamethasone (i.e. as the base) 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 concentrations > 40mg/ml
Diclofenac	*75mg in 3ml*
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 (colic, vomiting) 40-120mg/24 hours For airway secretions 20-60mg/24 hours	Non-sedative anticholinergic Reduces intestinal colic and peristalsis Some antisecretory effect in gastrointestinal tract
Hyoscine hydrobromide	*400 micrograms in 1ml*
For airway secretions 1200-1800 micrograms/ 24 hours	Sedative anticholinergic Can cause agitation and confusion A single bolus dose may be sufficient – see local guidelines for dose
Levomepromazine	*25mg in 1ml*
Antiemetic dose: 6.25-25mg/24 hours Terminal restlessness dose: 25-100mg/24 hours	Sedating at higher doses, reduces blood pressure: use low doses Long acting: can give SC once or twice daily Protect syringe and line from sunlight Reduces seizure threshold
Metoclopramide	*10mg in 2ml*
Nausea and vomiting especially due to gastric stasis/outlet obstruction, opioid induced nausea 40-80mg/24 hours	Prokinetic Avoid if complete intestinal obstruction suspected or patient has colic Extrapyramidal side effects if prolonged use and/or high dose
Midazolam	*10mg in 2ml*
Terminal restlessness/ anxiety and seizures/ myoclonus: 5-30mg/24 hours, up to 80mg/24 hours for heavy sedation	Anxiolytic (5-10mg/24 hours) Muscle relaxant (5-10mg/24 hours) Anticonvulsant (20-30mg/24 hours)
Octreotide	*100micrograms in 1ml, 500micrograms in 1ml*
Intractable vomiting due to intestinal obstruction, fistula discharge 300 – 900 micrograms/ 24 hours	Potent antisecretory agent in GI tract Does not treat nausea Try antiemetics & hyoscine butylbromide first Third line; high cost Excess hydration reduces effectiveness
Oxycodone	*10mg/ml, in 1ml and 2ml ampoules*
Patient unable to tolerate SC morphine/diamorphine at an adequate dose	**Seek specialist advice**

Refer also to chapter on *Prescribing in Palliative Care* in current BNF, and for detailed information to local palliative care guidelines, available on www.palliativecareargyllandclyde.org.uk.

Drugs not suitable for subcutaneous infusion

The drugs listed below must not be given by the subcutaneous route as they may cause tissue necrosis:

- Antibiotics
- Diazepam
- Chlorpromazine
- Prochlorperazine (Stemetil).

If you have any queries or concerns please see contact details of the Palliative Care Teams on page 50.

The use of medicines outwith a manufacturer's licence

The use of medicines outwith a manufacturer's licence ('off-label' use) is common practice in palliative care (e.g. administration by the subcutaneous route) but carries additional responsibilities for prescribers, pharmacists and nurses. Use outwith licence has not been specifically indicated for individual drugs, and practitioners may wish to take further advice from pharmacists or standard palliative care textbooks. Remember that the package inserts included with medicines only refer to the licensed indications, routes and doses.

Appendix 2
Diamorphine compatibility and diluent for single drugs

This appendix contains 5 tables relating to drug dilution and the compatibility of drug mixtures:

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

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

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

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

Table 5 Three drug combinations for subcutaneous infusion.

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).

Combinations

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.

The combinations in Table 5 have not been chemically tested for stability, but have been used in clinical practice and appear to be stable for 24 hours 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 the drug solution immediately prior to pump set-up. Do not run for more than 24 hours.

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 pharmacies at RAH, IRH, VOL, Lorn & Islands DGH, Dunoon Hospital/Cowal Hospice and the Mid-Argyll Community Hospital and Integrated Care Centre.
- Palliative care network community pharmacists (list of participating pharmacies in Appendix 6, 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 Driver*[1].

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 only)	Sodium chloride 0.9%. Do not mix with other drugs.
Ketamine (for specialist use only)	Sodium chloride 0.9% or dextrose 5%.
Ketorolac (used on specialist advice only)	Sodium chloride 0.9% or dextrose 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 stable[2]: give separately or consider alternative drugs or routes

Diamorphine, cyclizine and metoclopramide
Diamorphine, dexamethasone and levomepromazine
Diamorphine, dexamethasone and midazolam
Diamorphine, metoclopramide and ondansetron
Dexamethasone and haloperidol[1] (although stable at some doses with diamorphine – see Table 4)

Table 3 **Two** drug combinations for subcutaneous infusion which are stable for 24 hours[2] in water for injection

Note: figures in this table are not clinical doses
Refer to drug information table (page 35-36) and local palliative care guidelines for dosage information.

Drug combination	Stable combinations at amounts (mg) less than, or equal to, those in table 17ml in a 20ml syringe	 22ml in a 30ml syringe
Diamorphine	340	440
and Cyclizine	150	150
Diamorphine	850	1100
and Dexamethasone*	6	8
	Can precipitate if undiluted drugs are mixed during preparation	
Diamorphine	1700	2200
and Haloperidol	30	30
	If exceed these amounts then likely to get precipitate	
Diamorphine	2550	3300
and Hyoscine Hydrobromide	2.4 (2400 micrograms)	2.4 (2400 micrograms)
Diamorphine	2550	3300
and Hyoscine Butylbromide (Buscopan)	180	180
Diamorphine	850	1100
and Levomepromazine	170	220
	Mixture can be irritant, dilute to largest possible volume	
Diamorphine	2550	3300
and Metoclopramide	85	110
	Mixture can be irritant, dilute to largest possible volume	
Diamorphine	850	1100
and Midazolam	34	44
Diamorphine	425	550
and Octreotide	1.9 (1900 micrograms)	2.4 (2400 micrograms)

Table 4 **Three** drug combinations for subcutaneous infusion which are stable for 24 hours[2] in water for injection

Note: figures in this table are not clinical doses
Refer to drug information table (page 35-36) and local palliative care guidelines for dosage information.

Drug combination	Stable combinations at amounts (mg) less than, or equal to, those in table: 17ml in a 20ml syringe	22ml in a 30ml syringe
Diamorphine	340	440
and Cyclizine	150	150
and Haloperidol	30	30
Diamorphine	850	1100
and Dexamethasone*	6	8
and Haloperidol	17	22
	Only stable if diamorphine and haloperidol are well diluted before dexamethasone is added. Use only if no other options.	
Diamorphine	850	1100
and Dexamethasone	6	8
and Metoclopramide	51	66
Diamorphine	1190	1540
and Haloperidol	8	11
and Midazolam	68	88
Diamorphine	850	1100
and Levomepromazine	170	220
and Metoclopramide	51	66

*Consider whether dexamethasone can be given as a subcutaneous bolus injection once daily each morning as an alternative.

Table 5 Three drug combinations for subcutaneous infusion

These combinations have not been chemically tested but have been used in clinical practice and appear to be stable.

Combinations which appear to be stable at amounts (mg) less than, or equal to, those in table

Drug combination	17ml in a 20ml syringe	22ml in a 30ml syringe
Diamorphine	720	930
and Hyoscine Hydrobromide	1.6 (1600 micrograms)	2.0 (2000 micrograms)
and Midazolam	40	51
Diamorphine	1600	2070
and Levomepromazine	50	64
and Midazolam	30	38
Diamorphine	420	543
and Metoclopramide	60	77
and Midazolam	20	25

References

1 *The Syringe Driver*, 2nd edition, A Dickman, J Schneider, J Varga. Oxford University Press (2005).

2 Adapted from Annex 9 SIGN 44 *The Control of Pain in Patients with Cancer* (2000).

Appendix 3
Morphine guidance and compatibility

This **interim guidance** is extracted from a bulletin issued to practitioners 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 is improving but some shortages are expected to remain until mid-2008.
- **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.**
- When diamorphine is not available in the required strength or quantity 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 limited experience of use and there is considerable debate over conversion ratios with other opioids.
- **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 (12microgram/hour) is equivalent to about 45mg/24hours of oral morphine. (Note that use of the 12 microgram/hour patch to initiate transdermal fentanyl is 'off label' use.)
- 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. 22ml is the recommended maximum which will fit into a BD Plastipak 30ml syringe in the McKinley T34 syringe pump. When larger volumes are required, the options advised are to run 2 syringe pumps concurrently over 24hours, or consider alternative drugs. The McKinley T34 syringe pump will take a 50ml syringe (maximum fill volume 34ml) but lockboxes for this are not yet available. (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 pumps 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 community 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 network (Appendix 6 on page 51) will stock alternative preparations as advised by the Macmillan Pharmacist.

Compatibility information for morphine sulphate mixtures[1]: stable for 24hours in water for injection[2]

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.

Table 1: Compatibility for morphine sulphate: two drug mixtures

Drug	Compatible	Type of data
Metoclopramide	Yes	Visually compatible
Haloperidol	Yes	Visually compatible
Cyclizine	Yes	Visually compatible
Levomepromazine (Nozinan®)	Yes	Visually compatible
Hyoscine hydrobromide	Yes	Chemically compatible
Hyoscine butylbromide (Buscopan®)	Yes	Chemically compatible
Midazolam	Yes	Visually compatible
Octreotide	Yes	Visually compatible

Table 2: Compatibility for morphine sulphate: three drug mixtures

Drugs	Compatible	Type of data
Haloperidol & metoclopramide	Yes	Visually compatible
Cyclizine & haloperidol	Yes	Visually compatible
Hyoscine hydrobromide & haloperidol	Yes	Compatibility based on clinical experience
Midazolam & metoclopramide	Yes	Visually compatible
Midazolam & haloperidol	Yes	Visually compatible
Midazolam & cyclizine	Yes	Visually compatible
Midazolam & hyoscine hydrobromide	Yes	Visually compatible Compatibility based on clinical experience
Midazolam & levomepromazine	Yes	Visually compatible

1 Adapted by West of Scotland Pharmacy Palliative Care Network and Area Medicines Information Centre Glasgow from: Auckland District Health Board Department of Pharmacy 'Compatibility of syringe driver admixtures for continuous subcutaneous infusion 2002'. http://www.nzhpa.org.nz/SDAdCompProj.pdf

2 Note: Sodium chloride 0.9% is the recommended diluent for mixtures containing octreotide. For all other mixtures charted, the recommended diluent is water for injections.

Appendix 4
Suitable syringes

The recommended syringe to use with the McKinley T34 syringe pump in Argyll and Bute CHP and Clyde is the BD Plastipak. If these are unavailable the following Luer lock syringes are suitable. Below are the recommended maximum volumes in ml deliverable in each syringe. These figures have been rounded down to whole numbers for ease of use.

Syringe make/size	20ml	30ml
BD Plastipak	17	22
Braun Omnifix	20	24
Codan/ONCE	20	22
Monoject	18	
Terumo	18	24

Appendix 5
Sources of further advice

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

Primary Care

- Community Nurses
- Macmillan GP facilitator
- Macmillan Clinical Nurse Specialist
- Community pharmacy palliative care network (which can be accessed via patient's normal community pharmacy) – list of participating pharmacies in Appendix 6.

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.

Internet resources

- www.palliativecareglasgow.info
- www.palliativecareargyllandclyde.org.uk
- www.palliativedrugs.com

Note your local contact details here:

Advice is also available across Argyll and Bute CHP and Clyde from specialist practitioners:

Specialist Palliative Care Teams	
ACCORD Hospice Hawkhead Road Paisley	0141 581 2000
Ardgowan Hospice Nelson Street Greenock	01475 726830
Highland Hospice Ness House 1 Bishop's Road Inverness	01463 243132
St Vincent's Hospice Midton Road Howwood By Johnstone	01505 705635
Beatson Palliative Care Team Glasgow	0141 211 2411
Medical Consultant/Clinical Pharmacist Palliative Care Team Royal Alexandra Hospital Paisley	0141 887 9111 (switchboard)
Janet Trundle Macmillan Specialist Pharmacist in Palliative Care	01505 706873 or 0788 078 6659
Kate Lennon Macmillan Nurse Consultant in Palliative Care	07771 674373
Palliative Care Pharmacist Inverclyde Royal Hospital Greenock	01475 633777 (ask switchboard to page)
Elayne Harris Area Pharmacy Specialist (Palliative Care) NHS Greater Glasgow and Clyde	0141 427 8316 Radiopage: 07659 136753
Alison MacRobbie Palliative Care and Community Pharmacist NHS Highland	01463 706829

Appendix 6
Palliative care community pharmacy 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 pumps. Contact with these pharmacies may be made either through the patient's usual community pharmacy, or directly. Telephone numbers are pharmacy contact details. Pharmacies in the scheme in Argyll and Bute CHP and Clyde agree to hold the following medicines.

Medicines to be held in stock	**Strength**
Cyclizine injection	50mg/1ml
Dexamethasone injection	8mg/2ml
Diamorphine injection	5mg, 10mg, 30mg, 100mg, 500mg
During diamorphine shortage:	
Morphine sulphate injection	10mg/1ml, 30mg/1ml
Diclofenac injection	75mg/3ml
Haloperidol injection	5mg/1ml
Hyoscine Butylbromide injection	20mg/1ml
Hyoscine Hydrobromide injection	400mcg/1ml
Levomepromazine injection	25mg/1ml
Levomepromazine tablets (unlicensed)	6mg
Lorazepam (Genus make)	1mg
Metoclopramide injection	10mg/2ml
Midazolam injection	10mg/2ml
Morphine oral solution	10mg/5ml
Oxycodone injection	10mg/1ml, 20mg/2ml
Sodium Chloride injection	0.9% 10ml
Water for injection	10ml

Out of hours procedure when pharmacies are not open:

- Contact the Primary Care Emergency Centre (PCEC) to ascertain if they have the required medications or a suitable alternative.
- If the medication is not available in the PCEC (not all PCEC's stock Controlled Drugs), a community pharmacist can be called out by the 'hub' 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' and explain that palliative care drugs are required urgently.
- 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.
- The use of taxis may be required to uplift the prescriptions and deliver the drugs to the patient. These can only be authorised by the pharmacist.

The pharmacists' home contact details are for use only by the healthcare team, and must not be given to members of the public.

Out of hours procedure in hospitals
The on-call pharmacist can be contacted for supply.

Pharmacy details	Opening hours	
Pharmacies covered by Vale of Leven Hospital 'hub'		
Alliance Pharmacy 12/14 Mitchell Way **Alexandria** G83 0LW 01389 752012	Mon – Fri Sat	9.00 – 18.00 9.00 – 17.00
Fraser Pharmacy 152/4 Main Street **Barrhead** G78 1SG 0141 881 1750	Mon – Fri Sat	9.00 – 18.00 9.00 – 13.00
John Kemp Pharmacy 8 High Street **Dumbarton** G82 1LL 01389 762598	Mon/Tues/Thurs/Fri Wed Sat	9.00 – 17.45 9.00 – 17.30 9.00 – 17.00
Andrew Hughes Chemist Unit 4 Bridgewater Centre **Erskine** PA8 7AA 0141 812 0112	Mon – Fri Sat	9.00 – 18.00 9.00 – 17:30
Garelochhead Pharmacy, Unit 1 Campbell Buildings, Main Street **Garelochhead** G84 0FL 01436 810002	Mon – Fri Sat	9.00 – 17.30 9.00 – 12.00
Pettigrews Pharmacy 38 Cardwell Road **Gourock** PA19 1UH 01475 632028	Mon/Tues/Thurs/Fri Wed, Sat	9.00 – 17.30 9.00 – 17.00
Tesco Pharmacy 2 Dalrymple Street **Greenock** PA15 1LE 01475 497449	Mon – Sat Sun	8.00 – 21.00 10.00 – 18.00
L. Rowland & Co, Central Pharmacy 48 West Princes Street **Helensburgh** G84 8UG 01436 674186	Mon – Sat	9.00 – 18.00
The Village Pharmacy Houston Medical Centre, Kirk Road **Houston** PA6 7AR 01505 614739	Mon – Fri Sat	8.30 – 17.30 9.00 – 12.30
Penmans Pharmacy 5-7 William Street **Johnstone** PA5 8DP 01505 320116	Mon – Fri Sat	9.00 – 17:30 9.00 – 17.00

Pharmacy details	Opening hours	
Alliance Pharmacy Argyll Buildings **Kilcreggan** G84 0JH 01436 842457	Mon/Wed/Thurs/Fri Tues & Sat	9.00 – 13.00 & 14.00 – 17.30 9.00 – 13.00
Alliance Pharmacy Clippens Road **Linwood** PA3 3DG 01505 327505	Mon – Fri Sat	9.00 – 17.30 9.00 – 17.00
ASDA Pharmacy Phoenix Retail Park **Linwood** PA3 3BA 0141 842 8520	Mon – Fri Sat Sun	8.30 – 21.00 8.00 – 21.00 9.00 – 18.00
Abbey Chemist 27 Gauze Street **Paisley** PA1 1ES 0141 889 3377	Mon – Fri Sat	9.00 – 18.00 9.00 – 17:00
Parkinson Ltd 11 Broomlands Street **Paisley** PA1 2LS 0141 889 2576	Mon –Thurs Fri Sat	9.00 – 17.30 9.00 – 18.00 9.00 – 17:00
David Wyse Ltd 12 John Wood Street **Port Glasgow** PA14 5HU 01475 741035	Mon/Tues/Thurs/Fri Wed, Sat	9.00 – 17.30 9.00 – 16:30
Boots Chemist Unit MSU3, Braehead Shopping Centre **Renfrew** PA4 8WE 0141 885 9099	Mon – Fri Sat Sun	9.45 – 21.15 8.45 – 18.30 10.00 – 18.00
F A Parkinsons (Chemist) Ltd 4 High Street **Renfrew** PA4 8QR 0141 886 2085	Mon – Wed Thur – Fri Sat	9.00 – 17.30 9.00 – 17.45 9.00 – 17.00
Marchbanks 172 Main Street **Renton**, Dumbarton G82 4PE 01389 752914	Mon – Fri Sat	9.00 – 17.30 9.00 – 13.00
J B Spence Unit 4, Shopping Centre Ardgowan Road **Wemyss Bay** PA18 6AT 01475 522995	Mon/Tues/Thurs/Fri Wed Sat	9.00 – 13.00 14.00 – 18.00 9.00 – 13.00 14.00 – 17.30 9.00 – 13.00

Pharmacy details	Opening hours	
Pharmacies covered by Raigmore Hospital out of hours 'hub'		
Alliance Pharmacy 19 Main Street **Campbeltown** PA28 6AD 01586 553208	Mon/Tues/Thurs/Fri Wed Sat	9.00 – 17.30 9.00 – 13.00 9.00 – 17.00
Dalmally Pharmacy Main Road **Dalmally** PA33 1AX 01838 200465	Mon/Tues/Thurs/Fri Wed Sat	9.00 – 13.00 & 14.00 – 17.30 9.00 – 13.00 9.00 – 12.30
James Marshall Pharmacy 67 Argyll St **Dunoon**, Argyll PA23 7HG 01369 702157	Mon – Sat Every 4th Sun	9.00 – 17.30 12.00 – 13.00
Boots the Chemist Unit 2, Tweeddale Buildings High Street **Fort William** PH33 6EU 01397 705143	Mon – Fri Sat	8.45 – 18.00 8.45 – 17.30
Lloyds Pharmacy 52-54 High Street **Fort William** PH33 6AH 01397 702031	Mon – Fri Sat	9.00 – 18.00 9.00 – 17.30
J W McNulty 1 Main Street **Inveraray** PA32 8TU 01499 302133	Mon/Wed/Thurs/Fri	9.00 – 13.00
Lloyds Pharmacy 7 Victoria Street, Rothesay **Isle of Bute** PA20 0AJ 01700 502836	Mon – Sat	9.00 – 17.30
Islay Pharmacy Main Street, Bowmore **Isle of Islay** PA43 7JJ 01496 301591	Mon/Wed/Thurs/Fri Tues, Sat	9.00 – 18.00 9.00 – 13.00
Tobermory Pharmacy 46 Main Street, Tobermory **Isle of Mull** PA75 6PN 01688 302431	Mon/Tues/Thurs/Fri Wed, Sat	9.00 – 13.00 & 14.00 – 17.00 9.00 – 13.00
Argyll Pharmacies Ltd 12/14 Argyll Street **Lochgilphead** PA31 8LZ 01546 603217	Mon – Fri Sat	9.00 – 17.30 10.00 – 17.00

Pharmacy details	Opening hours	
Boots Chemist 34/38 George Street **Oban** PA34 5NL 01631 562517	Mon – Sat	8.45 – 17.30
Tarbert Pharmacy Bannockburn Building **Tarbert** PA29 6TW 01880 820232	Mon – Fri Sat	9.00 – 17.30 9.00 – 17.00

Pharmacies in Glasgow, open for extended hours including public holidays

Lloyds Pharmacy 1851/1855 Paisley Road West **Glasgow** G51 3SX 0141 882 1513	Mon – Sun	9.00 – 21.00
Munro Chemist 263 Alderman Road **Knightswood** G13 3AY 0141 9591914	Mon – Sun	9.00 – 23.00

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

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