# McKinley T34 Syringe Pump Policy and Procedure

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| In consultation with | Medicines Management North Somerset CCG  
| To be read in association with | Medicines Policy – Safe and secure handling of Medicines  
|                           | Incident Reporting Policy and Procedure  
|                           | Anticipatory prescribing of ‘Just in Case’ medication for symptom control in the last days of life in adult community palliative care patients – SOP and Clinical Guidelines for BNSSG  
|                           | Pain Assessment and Management Policy  
|                           | Clinical Procedure Verifying an Expected Death  
|                           | Last day of Life Care plan (to be released in late October 2016)  
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|                           | Effective  
|                           | Responsive  
|                           | Well Led  
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If you require this document in a different format, please contact the Governance team on 01275 546831
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1. **Introduction**

The National Patient Safety Agency (NPSA) alert (December 2010), Safer ambulatory syringe drivers, identified that while the majority of syringe drivers and pumps used in healthcare have rate settings in millilitres (ml), some older types of ambulatory syringe drivers have rate settings in millimetres (mm) of syringe plunger travel. This is not intuitive for many users and not easy to check. Errors include the wrong rate of infusion caused by inaccurate measurement of fluid length or miscalculation or incorrect rate setting of the device. Dose errors also occur because of different models using mm per hour or mm per 24 hours. Other issues include syringes becoming dislodged, inadequate device alarms and lack of internal memory (a technical issue which makes establishing the reason for any over or under-infusion difficult).

In line with the Medicines and Healthcare Products Regulatory Agency (MHRA) recommendations for infusion systems, North Somerset Community Partnership changed to the McKinley T34 Syringe Pump from the Graseby MS26 and MS16a syringe drivers in 2014. If subsequent requests for support with Graseby units arise, they will be declined as competency in the use of Graseby units cannot be assured.

PLUSS has been contracted to provide the hire service for the T34 syringe pumps until the end of January 2016. Since then, a procurement of T34 syringe pumps has enabled the NSCP trained staff to administer medications.

2. **Purpose / Objective of the Document**

This policy has been developed to inform employees of North Somerset Community Partnership involved with administering drugs via an ambulatory syringe pump. It should promote uniformity amongst those employees’, be it in the hospital or community setting. This document is in response to changes in national policy, and practice and development within the palliative care speciality.

3. **Background**

The syringe driver was developed in 1979 by Dr. Martin Wright for use in treating Thalassaemia with infusions of Desferrioxamine (Wright & Callan, 1979). The use of a portable battery operated syringe driver for subcutaneous medications is now a well-established technique in palliative care; this view is supported by Dickman et al (2005), who suggests “that it is particularly suited to palliative care”. The syringe driver, “allows for a minimally invasive route of drug administration, which produces relatively constant levels of medication avoiding peaks, which can result in reduced symptom control” (Hunt 2002).

Palliative care patients often present with multiple symptoms that can necessitate the need to use several drug treatments. If the patient’s condition deteriorates and the oral route cannot be used Dickman et al. (2005) further suggests “a continuous subcutaneous infusion via the syringe driver provides a simple and effective way to control symptoms”. The McKinley T34 Syringe Pump is a more advanced delivery system than a syringe driver and is a typical example of ambulatory syringe pumps;
however, other types are available and professionals should follow the manufacturer’s instruction manual for details of their use.

4. Definitions

A McKinley T34 syringe pump is a portable battery-operated infusion pump weighing approximately 210g (excluding the battery) and measuring 169mm by 53mm by 23mm.

The McKinley T34 model is calibrated in ml per hour. All T34 pumps for palliative care are set up to deliver the syringe contents by continuous subcutaneous infusion over a 24 hour period only. All pumps must be checked that the display shows ‘PLUSS HIRE NSCP’ when switched on. (NOTE: ‘NSCP’ will be displayed when SMART card is available for MEMO to re-programme the drivers)

Occasionally patients may require continuous subcutaneous infusion over 12 hours for symptom management. This is not standard practice within NSCP. In every case a risk assessment should be completed by the line manager. Specialists in palliative care should be involved in the decision to use a syringe pump over 12 hours and all other options exhausted before this practice is undertaken by NSCP employees. NSCP employees involved in the care of these patients may need to contact the Learning and Development for specific training on how to operate the syringe pump over 12 hours to ensure the risk of medication error is minimised.

5. Indications for Use

- Persistent nausea and vomiting
- Inability to swallow oral medication
- Profound weakness or unconsciousness
- Poor gastrointestinal absorption
- Intestinal obstruction

6. Equipment

Syringe type

The McKinley T34 pump can be used with most makes of syringes. **NSCP units will only be compatible with Becton Dickinson (BD) syringes.** NSCP pumps will be programmed to recognise this manufacturer only. Consumables can be ordered by community teams on the EROS system..

The most commonly used syringes have been 10ml and 20ml, however it has been more recently advocated (Dickman 2005) that a 20ml syringe is the recommended minimum for several reasons: a larger dilution will reduce both the risks of adverse site reactions and incompatibility and it also accommodates large doses of drugs. It is therefore recommended that **20ml and 30ml BD syringes should be used and that they MUST have a luerlock facility in order to avoid leakage or accidental disconnection.**
Note: The 50ml luerlock syringe is the largest syringe that will fit the McKinley T34 syringe pump. It allows drugs to be diluted up to approximately 34mls volume. This reduces the need for a second syringe pump when giving larger volume drugs e.g. Metoclopramide. **A 50ml syringe is not recommended for routine use. It will not fit into the standard lockbox but may be used for specific problem infusions. Risk assess each situation and discuss with line manager.**

Table 1: Syringe fill volume
(McKinley T34 Ambulatory Syringe Pump Operation Manual, March 2006)

<table>
<thead>
<tr>
<th>Size of BD syringe</th>
<th>Suggested fill volume (if recharging)</th>
<th>Maximum fill volume (if priming line)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20ml syringe</td>
<td>17ml</td>
<td>18ml</td>
</tr>
<tr>
<td>30ml syringe</td>
<td>22ml</td>
<td>23.5ml</td>
</tr>
<tr>
<td>50ml syringe (exceptional circumstances only)</td>
<td>34ml</td>
<td>34.9ml</td>
</tr>
</tbody>
</table>

Equipment required

It is the responsibility of the nurse setting up the equipment to ensure that the syringe pump is clean, visually intact with an intact lockbox.

Equipment

- McKinley T34 syringe pump
- Duracell Battery, PP3: 9 volt alkaline/lithium. Plus spare battery as a new battery will last for approximately 3-4 days depending on use
- 20ml and 30ml luerlock BD syringes
- 2 x 2ml syringes
- BD Saf-T-Intima line and plug
- Syringe Driver Universal Extension Set (code:100-172SX)
- Transparent adhesive dressing e.g. c-view
- Yellow label for final syringe
- Blunt drawing up needle
- Lockbox and key
- Disposable carry pouch. Single use only.

Additional equipment required

- Community Palliative Care Drug Chart
- T34 Syringe Driver Monitoring Chart
- Prescribed medicines and diluents (usually water for injection)
- Patients electric razor (for hair removal if necessary)
- Scissors to open tool box
- Extra needle supplies
- Disposable holster
- Sharps box
7. Choosing the Site

- Explain the intended procedure to patient
- Patient should be given a choice for the site of infusion, if possible
- For subcutaneous infusion consider using upper arm, anterior or posterior chest wall, abdomen, thigh (except in ambulatory patients, risk of syphonage)
- The sites should be rotated at each cannula/line change

Sites to avoid

- Lymphoedematous limbs or abdomen (risk of malabsorption, tissue trauma and infection)
- Chest wall in very cachectic patients (risk of pneumothorax)
- Upper abdomen in patients with an enlarged liver (risk of puncturing liver capsule)
- Bony prominences or near joints
- Abdomen in patients with ascites
- Recently irradiated skin
- Tumour sites
- Skin folds
8. Changing the Infusion Line

A new infusion line should be used if the patient's line becomes occluded or the combination of medication is being changed, to prevent the risk of precipitation due to the mixing of drugs in the line. There is no need to change the line if it is only the dose of medication that is being changed.

There is no clear information about the optimum time to change needles and lines. Subcutaneous cannula should be changed weekly, as a minimum, unless the patient reports discomfort or there are visible signs of inflammation. In this case the subcutaneous cannula should be changed immediately using a new site.

If the skin becomes inflamed or line needs frequent changes consider:

- If medication being used is irritant e.g. cyclizine, the dilution can be increased by using a bigger syringe or seek advice regarding alternative medication
- Use a different dressing if there is evidence of inflammation due to an allergy reaction

9. Procedure

9.1 Filling the syringe

One drug in the syringe pump
- Calculate the volume of drug needed from the concentration of the preparation you have and the prescribed dose
- Select appropriate syringe size (use a BD luerlock syringe of at least 20ml). Refer to Table 1 for suggested/maximum fill volumes
- Draw up the prescribed medication and then add diluent (usually water for injection) to appropriate volume
- Draw up a little air into the syringe, invert it gently several times to mix (there needs to be a little air in the syringe for this to be effective), and then expel the air. Take care not to expel any of the medication.
- **Note:** If the drug is available in a powdered form and the dose required is only part of the ampoule, you will need to measure accurately the amount of diluent used for reconstitution, and calculate the volume of solution required

Two or three drugs in the syringe pump
- Check compatibility charts or seek advice from a pharmacist, palliative care specialist or local Hospice
- **Note:** If Dexamethasone required give as a once or twice daily subcutaneous bolus injection to avoid potential problems with compatibility or use a separate syringe driver
- Calculate the volume for each prescribed drug and establish final volume required
- Select appropriate syringe size (use a BD luerlock syringe of at least 20ml) Refer to Table 1 for suggested/maximum fill volumes
• Reconstitute opioid (if necessary) and draw into luerlock syringe. If no opioid prescribed draw up one of the prescribed drugs into the luerlock syringe.
• Dilute to an appropriate volume (total volume less volume of second and third drug)
• Draw up the second drug into a separate syringe of appropriate size and leave needle attached
• Pull back plunger on luerlock syringe to beyond final intended volume, and add second drug carefully through the luer end
• Invert it gently several times to mix (there needs to be a little air in the syringe for this to be effective), and then expel the air. Take care not to expel any of the medication.
• Draw up the third drug (if prescribed) into a separate syringe of appropriate size and leave needle attached
• Pull back plunger on luerlock syringe to beyond final intended volume and add third carefully through the luer end
• Invert it gently several times to mix (there needs to be a little air in the syringe for this to be effective) and then expel the air. Take care not to expel any of the medication.

More than 3 drugs in a syringe pump
This is not routine practice in North Somerset Community Partnership. Seek advice from a pharmacist, palliative care specialist or St Peter's Hospice about compatibility and alternative options.

Overfilling of ampoules
Ampoules containing liquid forms of drugs have the amount of drug expressed as mg/ml. Some manufacturers ‘overfill’ the ampoule (e.g. Metoclopramide 10mg/2ml may be filled to 2.2mls) so the exact volume withdrawn from each ampoule must be measured. If all the solution is drawn up a higher dose will be administered than the dose prescribed.

9.2 Labelling the syringe

• All syringes containing drug additives must be labelled
• If there is any doubt as to the contents of a syringe, the contents should be discarded. This is particularly important for continuity of care, especially where patients transfer from one care setting to another.
• Complete the label details in indelible ink
• The label must state:
  o Patient name
  o Ward/team
  o Date and time of syringe preparation
  o Expiry date and time of preparation
  o Initials of the person preparing the contents
  o Name and dose of all drugs e.g. morphine 15mg, haloperidol 5mg, etc.
  o Batch numbers of drugs
  o Name of diluent e.g. water for injection
Intended route of infusion

- Attach label to the syringe. Ideally the label should be placed flat and unfolded to avoid obstructing the pump mechanism. Leave the volume scale visible so that it can still be read.

### 9.3 Pre-loading and syringe placement

- Install the battery (always use the Duracell 9V battery, with international code 6LR61 on the battery or packaging)
- Switch on the T34 and check the display reads PLUSS HIRE NSCP (or ‘NSCP’ once the pump is re-calibrated by MEMO)
- The display will then read PRE-LOADING and the actuator will start to move. Wait until it stops moving and the syringe graphic appears.
- **Note:** During Pre-Loading the actuator always returns to the start position of the last infusion programmed and may need adjusting prior to fitting the syringe.
- Check the battery life by pressing the INFO key once and scroll through options to view ‘Battery life’.
- Press YES to display the charge remaining.
- Discard the battery if 40% or less remaining at the start of the infusion. Average battery life is 3-4 days depending on use.
- Document the % of charge remaining on the T34 Syringe Driver Monitoring Chart (see Appendix)

### 9.4 Connecting infusion set to the syringe

- Connect the infusion line securely to the syringe
- If it is a new infusion set, gently depress the syringe plunger to manually prime the line
- If the pump actuator is not in the correct position to accommodate the syringe, ensure the barrel clamp arm is down and use the FF or BACK buttons on the keypad to move the actuator. Forward movement of the actuator is limited, for safety; therefore repeated presses of the FF key may be required when moving the actuator forward. Backwards movement is not restricted.

### 9.5 Fitting the syringe to the pump

- For safety reasons, the syringe must be attached to the pump 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 Medicines Policy.
- Lift and turn the barrel clamp arm.
- Place the syringe collar vertically into the pump collar slot and the syringe plunger into the pump plunger slot (the syringe should click into position)
- Ensure that the scale on the syringe barrel is facing forward so that it can be easily read
• Turn and lower the barrel clamp arm onto the syringe. Note: The syringe graphic on the screen ceases to flash when the syringe is correctly seated at all 3 points.
• The syringe size and brand option will then be displayed as shown below

| 20 ml BD Plastipak | Select (arrows), Press YES |

• Confirm that the syringe size and brand match the screen message and Press YES to confirm.

9.6 Starting the infusion (new syringe)

After syringe confirmation, an example of the first screen that appears is shown below:

<table>
<thead>
<tr>
<th>Volume</th>
<th>20.3ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>24.00</td>
</tr>
<tr>
<td>Rate</td>
<td>0.85ml/hr</td>
</tr>
<tr>
<td>Confirm</td>
<td>PRESS YES</td>
</tr>
</tbody>
</table>

• The pump calculates and displays the deliverable volume, duration of infusion and rate of infusion.
• Check if the volume in the syringe matches the volume displayed
• Check the duration displayed is 24 hours
• The syringe pump will automatically calculate the rate of drug delivery once the syringe is fitted to the pump correctly, but it is good practice to check that the rate is correct using this calculation:

  Rate (ml/hour) = Volume (ml) / Duration (hours)

• Press YES to confirm if correct
• **Note:** A new programme must be set for each new syringe. If the pump gives the option of resuming a previous programme, it has been set up incorrectly and the operator should return to 9.3 Pre-loading and syringe placement.

9.7 Start the syringe pump

• Pump screen prompts ‘Start Infusion?’
• Press YES to start infusion when ready to do so.
• **Note:** If the infusion has not been started and a button has not been pressed for more than two minutes, an alarm will sound and the message below will be displayed:

| Pump Paused Too Long | Confirm, Press YES |
• To stop the alarm, press ‘YES’ and continue programming the infusion.

• When the pump is running the screen displays (example only):

<table>
<thead>
<tr>
<th>Time Remaining: 23:59</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate: 0.66ml/h</td>
</tr>
<tr>
<td>20ml BD Plastipak</td>
</tr>
</tbody>
</table>

• The red ON/OFF light goes out and the green LED indicator flashes every 32 seconds.

• Ensure the patient and carers know that the syringe pump MUST NOT be placed at a level higher than the infusion site. (It is possible for the contents to siphon out). **Note:** This is still a sensible precaution even with an anti-siphon set as they may not be 100% reliable.

• Never take a syringe that is not empty off the pump if it is still connected to the patient.

**Note:** It takes 4-6 hours for drugs to reach therapeutic blood plasma levels via the syringe pump, therefore, the patient may require initial (STAT) doses to be administered when the syringe pump is set up if they have unrelieved symptoms.

9.8 Keypad lock

The T34 allows all 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**

• With the pump infusing, press and hold the INFO key until the graphic **fills** from left to right and an audible beep is heard. This confirms that the lock has been activated.

• Although the keypad lock is on, the following buttons are still active: NO/STOP; YES/START; INFO

**To de-activate the Keypad Lock**

• Press and hold the INFO key until the graphic **empties** from right to left and an audible beep is heard. This confirms that the lock has been deactivated.

9.9 Lockboxes

Every T34 will be supplied with a lockbox. After starting the infusion, place the pump in the supplied lockbox. Universal keys will be supplied with each tool box set for community nurse. Replacement keys if required are the responsibility of the individual teams. If a key is lost complete an incident report form.

If alarm is activated due to occlusion/ empty syringe, the unit will alarm until either the nurse arrives or the battery is removed. In the event of a delay e.g. travel time to
location, the individual can be taught how to remove the battery from the case. This is possible without unlocking the lock box:

- Reverse of unit, slide battery cover from unit
- Remove battery
- Replace cover
- Await clinician to recharge unit

9.10 Daily renewal of medication when reusing the infusion set

- Stop the infusion by pressing the STOP key
- Unlock the lockbox and remove the pump
- Deactivate the keypad lock
- Switch the pump off by pressing the ON/OFF key until the unit display goes dark. The pump must be switched off with the syringe removed before loading a new syringe as part of the process of deleting the last programme
- Draw up the medication to the prescribed volume
- Ensure the barrel clamp arm is down and no syringe is in place
- Switch on the syringe pump and wait for automatic movement of the actuator
- Adjust the actuator using the FF or BACK key
- Check the battery life (replace battery if 40% or less)
- Load the syringe into the pump
- Connect the syringe to the infusion line
- Confirm the infusion should be started by pressing the YES key
- Lock the keypad
- Put the pump in the lockbox and lock securely
- Place away from light to avoid precipitation of light sensitive drugs
- Document on appropriate paperwork

9.11 Stopping the infusion and removing the syringe pump

- When the infusion is nearing completion, a warning will be shown on the 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 button to switch off the pump.
- If the infusion is to be stopped before the syringe is empty, it should also be disconnected at the syringe end from the patient for safety reasons before the syringe is taken off the pump. A syringe that is not empty must NEVER be taken off the pump while connected to the patient.
- Wipe clean with a cloth soaked in warm water if the equipment is visibly contaminated. Do not immerse pump in water.
- Dry and replace in packaging if no longer required for use.
9.12 What to do if the patient dies when the syringe pump is running

- Stop the pump only after death has been formally verified.
- Stop the pump by pressing the STOP button and remove the cannula as soon as possible. Switch off the pump by disabling the keypad lock and then press and hold the ON/OFF button.
- Record the date, time and amount of solution remaining in the syringe (mls) and destroyed in the patients notes. The signature(s) of the person(s) present and witness (if there is one).

9.13 Temporarily stopping 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 to stop the infusion
- DO NOT remove syringe from pump whilst it is connected to the patient, to avoid administering an inadvertent bolus dose.

Resuming the Infusion

- Check that the prescription, syringe label and patient details match, to ensure that this is the correct syringe for this patient.
- Press YES to resume the previous programme. **Note:** If it is necessary to re-programme return to 9.3 Pre-loading and syringe placement.
- The screen will display remaining volume, duration and rate of infusion – visually check that this information is correct.

9.14 Changing the battery when an infusion is running

- With the infusion still running, remove the old battery from the pump and replace with a new one
  - Reverse of unit, slide battery cover from unit
  - Replace battery
  - Replace cover
- Switch the pump back on using the ON/OFF button
- Confirm the size and make of the syringe by pressing YES
- Press YES to resume infusion
- The screen will display the remaining volume, duration and rate of infusion. Check all information is correct and press YES to confirm
- Screen will display START INFUSION Press YES to confirm.
10. **Documentation and Monitoring**

a. **NHS Community Palliative Care Drug Chart including:**
   - Patient details
   - Allergies/sensitivities
   - Prescriber details
   - Details of person administration drugs
   - Once only medicines
   - PRN subcutaneous medication
   - Syringe pump medication

b. **T34 Syringe Driver Monitoring Chart including:**
   - Patient name, date of birth, NHS number
   - Syringe Pump asset number
   - Date and time
   - Syringe size used 20ml, 30ml or 50ml (exceptional circumstances)
   - Confirmed self-test
   - Site of administration checked
   - Drug interaction checked
   - Battery charge remaining
   - LED indicator light checked
   - Lock mode and lock box checked

c. **EMIS and patient's note**

The operation of the pump should be checked and the patient monitored:

- Within one hour of set-up (e.g. in community, just before leaving the patient’s house)
- And then:
  - 4 hourly in hospital setting
  - 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. **Note:** In the community, the patient and/or carer must be instructed on what to do, and who to contact, if a problem arises.

Check that the patient's symptoms are controlled and record details of ongoing monitoring checks on the recording chart including:

- Date and time
- Site used/checked and actions taken if not satisfactory
- 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).
- Time remaining on running screen (hours)
- Rate (ml per hour)
- Check that the green LED light is flashing every 32 seconds and that the bottom line of the LCD display is alternating between <<<< Pump Delivering and the make/size of syringe.
- Check that line is securely attached to syringe and not leaking, and line not kinked or trapped.
- Name and signature of person checking

Always assess the 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 (ml) in the patients notes.

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 the syringe barrel or tip, or presence of large amount of air (may indicate cracked syringe barrel)
- Site reaction

11. Responsibilities

11.1 Safety Risk Management

Parenteral administration of medicines carries a number of risks which have been well documented. Syringe pumps may be used infrequently and competency can be difficult to maintain where use is infrequent. This policy aims to provide guidance and advice to NSCP employees to minimise these risks and at the same time enables dissemination of consistent advice and best practice.

11.2 Pump Maintenance

All syringe pumps will be serviced regularly BY MEMO AT WESTON HOSPITAL according to a defined schedule and at least annually, whether used or not. Syringe pumps should be RETURNED FOR MEMO AT WESTON HOSPITAL for maintenance checks if they have been dropped or submerged in fluid or if there is any doubt as to their handling operation whilst in use.

11.3 Cleansing and Decontamination

All units will be decontaminated on return to the base. Antibacterial or antiviral decontamination products can be ordered from EROS. However, if the unit becomes visibly contaminated whilst in use, cleansing should be carried out with a damp disposable cloth (use warm water and general purpose detergent). Dry thoroughly.
The pump must **not be submerged** in water (and if it is accidentally dropped in water, it must **be withdrawn from use** immediately and be **returned to MEMO** at Weston Hospital).

**Do not use** chemicals such as Xylene, acetone/similar solvents or Cliniwipes (or similar) as this will cause damage to components and labels.

### 11.4 Incident reporting

Systems are in place within North Somerset Community Partnership to report and monitor incidents and staff should be familiar with the Incident Reporting Policy and Procedure on the NSCP website and how to use the Datix system. Any member of staff can and has a professional responsibility to report an incident to their line manager and complete an incident report. All incidents will be investigated. Audit of this information, along with audit against the standards for use of syringe pumps assists in identifying training needs.

An incident report should be completed in the following situations:

- Administration of incorrect medication, dose and/or diluents
- Infusions completing ahead of intended time or carrying on beyond intended time of completion
- Device not alarming
- Any other incident or near miss which may compromise patient safety or comfort
- **Note:** Any device and consumable involved in an adverse incident should be "quarantined" at the base for further notice.

### 12. Troubleshooting

#### 12.1 Pump will not start or pump stops before syringe empty

- Check the battery is present
- Check battery inserted correctly
- Check battery level it may be depleted/very low
- Check syringe securely attached to pump
- If suspect pump faulty change the entire syringe pump for a new one and send original for servicing
- If part of a syringe remaining, remake and set up from beginning

#### 12.2 Pump running fast

- If major over-infusion, stop infusion, check condition of patient and seek medical advice. Report as a medication incident.
- Check for disconnection of line or cannula.
- Check the correct syringe brand or size has been selected.
- Check syringe securely attached to pump.
- Check no air present in syringe (solution will siphon out if barrel cracked).
- Change the entire syringe pump for a new one and send original for servicing.
- Check that the pump has not been placed above the height of the patient (siphonage could have occurred).

**12.3 Pump running slow**

- Check the syringe pump light is GREEN and flashing
- Check the battery level
- Check the correct (luer lock) syringe brand or size has been selected.
- Check that syringe is inserted correctly into syringe pump (actuator is still against plunger)
- Ascertain if syringe pump has been stopped and restarted for any reason
- Check contents of syringe and line - is there any evidence of crystallisation/kinking of tubing?
- Check cannula site - is this red/hard/lumpy/sore?
- Change cannula site if necessary
- Consider further dilution of drugs to minimise irritation by setting up a fresh syringe
- If syringe pump continues to run slowly, change entire pump and send for servicing
- Check rate of infusion at regular intervals

**12.4 Site irritation**

- Change site (use a new winged infusion set/extension line when changing site)
- Discuss possible change of drugs with doctor (cyclizine and levomepromazine = most common cause)
- Dilute drugs to a larger volume in new syringe
- Consider separating into 2 syringe pumps
- Consider infection
- Consider other possible routes of drug administration 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

**12.5 Precipitation identified**

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 pumps or give one drug as a subcutaneous bolus injection
• 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 a different site with new cannula and extension line/winged infusion set

13. **Alarming Device**

When the pump detects a problem four things occur:

• The infusion stops
• An audible alarm is activated
• A message appears on the display screen indicating the cause of the alarm
• The LED indicator turns RED

The alarms will sound for the following reasons:

<table>
<thead>
<tr>
<th>LCD Display</th>
<th>Alarm type</th>
<th>Possible Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occlusion/Syringe Empty Check line &amp; Syringe Press YES to confirm</td>
<td>Audible and visual alarm Intermittent beep</td>
<td>Patient cannula/line blocked, kinked. Occlusion. Infusion has finished</td>
<td>Remove occlusion and restart. Flush/change cannula as per local policy. End of program, switch pump off</td>
</tr>
<tr>
<td>Syringe displaced, Check Syringe, Press YES to confirm</td>
<td>Audible and visual alarm Intermittent beep</td>
<td>Syringe has been removed or displaced</td>
<td>Check and confirm syringe seated correctly and resume infusion. Syringe flanges need to be in the vertical position at all times</td>
</tr>
</tbody>
</table>
### Unlicensed Use of Medicines

Changes to medicines legislation in 2009 recognised that mixing two or more medicinal products together may be in the best interests of some patients. It is particularly useful in end of life care to achieve good symptom control. Mixing is the combination of two or more medicinal products together, for the purposes of administering them to meet the needs of a particular patient.

Mixing two or more licensed drugs together results in a new unlicensed product being formed. It is common to mix 2 or 3 different drugs in one syringe pump, but mixing more than 3 drugs in one syringe pump requires specialist advice. There should be compatibility evidence to support mixing of multiple drugs in a syringe pump.

The prescriber must direct others to mix drugs for administration to a particular patient. Directions must be in writing. Those undertaking the mixing of medicines must be competent to do so and take full professional and clinical responsibility for their actions. The mixer should not feel obliged to mix medicines if they do not feel competent or confident in doing so.

<table>
<thead>
<tr>
<th>Pump Paused Too Long Confirm, Press YES</th>
<th>Audible and visual alarm Intermittent beep</th>
<th>Pump left or no key presses detected for 2 minutes</th>
<th>Start infusion, continue programming or switch off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near End</td>
<td>Audible and visual alarm Intermittent beep</td>
<td>15 minutes from end of infusion</td>
<td>Prepare to change syringe or switch off</td>
</tr>
<tr>
<td>End Program Press YES to Confirm</td>
<td>Audible and visual alarm Intermittent beep</td>
<td>Infusion complete</td>
<td>Pump will alarm. Press ‘YES’ to confirm end of programme and ‘OFF’ to switch pump off</td>
</tr>
<tr>
<td>Low Battery</td>
<td>Visual alarm</td>
<td>Battery is almost depleted (30 minutes left)</td>
<td>Prepare to change battery and resume infusion</td>
</tr>
<tr>
<td>Battery End</td>
<td>Visual alarm</td>
<td>Battery is depleted</td>
<td>Change battery and resume infusion</td>
</tr>
</tbody>
</table>

14. **Unlicensed Use of Medicines**
Unlicensed use of medication can be supported by experience in clinical practice and accepted reference sources such as The Oxford Textbook of Palliative Medicine or the Palliative Care Formulary or local/national guidelines.

15. Converting to a Syringe Driver

<table>
<thead>
<tr>
<th>Patient is currently taking this drug</th>
<th>Divide total 24 hour oral dose by</th>
<th>To convert to syringe driver administered over 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral morphine</td>
<td>2</td>
<td>Subcutaneous morphine</td>
</tr>
<tr>
<td>Oral morphine</td>
<td>2</td>
<td>Subcutaneous oxycodone</td>
</tr>
<tr>
<td>Oral morphine</td>
<td>3</td>
<td>Subcutaneous diamorphine</td>
</tr>
<tr>
<td>Oral oxycodone</td>
<td>2</td>
<td>Subcutaneous oxycodone</td>
</tr>
</tbody>
</table>

Conversion information taken from BNF 66 and Palliative Care Formulary (4th Edition)

There is a small difference between the potency of injectable morphine and oxycodone (morphine 10mg is approximately equivalent to oxycodone 13mg). However in clinical practice and considering ampoule size, it is reasonable to use the same dose when converting from one to the other.

If the patient is taking any other oral opioids or if unsure ask for advice on safe conversion from a pharmacist, palliative care team or St Peter’s Hospice.

Transdermal patches (Fentanyl/Buprenorphine) should generally be continued if the need for a syringe pump is likely to be short-term. If pain is not well controlled on transdermal opioids, ask for advice from your hospital palliative care team, pharmacist or St Peter’s Hospice.

Appropriate doses of rescue medication as STAT or PRN doses should always be prescribed and given via a separate SC needle/cannula and flushed with compatible diluent. Regular use of rescue medication indicates a need for reassessment of patient.

16. Diluent

Water for injection should be used to dilute all drugs (except ketamine, dilute in Sodium Chloride 0.9%). There is a wealth of supporting compatibility data and clinical experience with water for injection.

Sodium Chloride 0.9% is incompatible with cyclizine, higher concentrations of haloperidol and diamorphine. Ask for advice from the palliative care team, pharmacist or St Peter’s Hospice if one or more drug needs to be diluted in sodium chloride.
17. **Compatibility and Stability**

‘Instability’ or ‘incompatibility’ refers to chemical changes that occur when diluting or mixing drugs, resulting in the formation of different chemicals that can be therapeutically inactive or possibly toxic to the patient. Sometimes there are visible signs of incompatibility such as cloudiness, change in colour or the appearance of crystals (precipitation). However, some reactions will not be identified through changes in appearance. If in doubt, contact a pharmacist, palliative care team or local Hospice.

Factors that affect stability include light, heat, pH, time and volume of diluent. Therefore, if a solution is to be given by continuous subcutaneous infusion, it is important to know that it will be stable in a suitable volume for 24 hours at room temperature.

Crystals are potentially an irritant to the patient’s skin, reduce the effect of the drug and are a common reason for syringe pump failure. The solution must be visually checked for precipitation in both the syringe and the tubing of the giving set. The infusion must not be given if there are signs of incompatibility and advice should be sought from your palliative care team, pharmacist or St Peter’s Hospice.

The tubing of the giving set should be protected from light as this reduces the risk of precipitation when a drug is light sensitive. The tubing should be placed in a protective bag or under the pillow/clothes to avoid exposure to direct sunlight.

Where incompatibilities are found e.g. crystal formation, details should be submitted to the Syringe Driver Survey Database (SDSD) on [www.palliativedrugs.com](http://www.palliativedrugs.com) to help build a database of evidence for drug combinations.

The most common drugs to precipitate are:

- **Cyclizine lactate** is incompatible with sodium chloride 0.9% and can be incompatible with high doses of diamorphine
- **Hyoscine Butylbromide** can be incompatible with cyclizine
- **Dexamethasone** is alkaline in solution and the majority of other drugs are acidic so precipitation is common when mixed with other drugs. Dexamethasone has a long duration of action and if required it is usually given as a separate bolus SC injection once or twice daily.

**Note:**

- Chlorpromazine, prochlorperazine and diazepam **must not** be given by the subcutaneous route because they cause skin reactions at the injection site.
- Cyclizine and levomepromazine may sometimes cause local skin irritation.

18. **Care during Infusion**

- Explain care of the pump to patient/carer e.g. avoid spillage of liquids or dropping the pump and to report if light stops flashing or if an alarm should sound
- Check battery daily
- Avoid using mobile telephone nearer than 1metre to the syringe pump (McKinley Medical UK Ltd). Although there are no confirmed reports of mobile phones interfering with the operation of the syringe pump, following this advice will help reduce any risk
- When the patient is mobile, ensure syringe pump is well supported i.e. placed in a disposable holster
- Protect the pump from direct sunlight
- Care during bathing/shower - care must be taken not to get unit wet

19. Training

All registered nurses employed by NSCP using the McKinley T34 syringe pump must be personally competent and accountable in the use and operation of the device.

Line managers should ensure that relevant training takes place (e.g. MLE training on T34 syringe pumps under the End of Life Care) and maintain a record of staff that is trained and competent to use such devices.

Updates once competent should be every three years this is the practitioners responsibility to maintain competence.

20. References

British National Formulary (current) Accessed online www.bnf.org.uk


McKinley Medical UK Limited. Ambulatory Syringe Pump Instruction Manual
McKinley T34, June 2005.


SIGN Guideline 106 November 2008 Control of pain in adults with cancer


21. Associated Documents

St Peters Hospice / Weston Hospice Anticipatory prescribing for end of Life symptoms in the community
http://www.stpetershospice.org.uk/userfiles/files/Anticipatory%20prescribing%20for%20end%20of%20life%20symptoms%20in%20the%20community.pdf

End of Life Care website Somerset and North Somerset
www.nssomersetendoflifecare.nhs.uk

22. Acknowledgements

NHS Greater Glasgow and Clyde for their agreement to use information from their T34 policy
23. Drugs commonly used in Syringe Driver

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Indications</th>
<th>Potential adverse effects</th>
<th>Usual dose range</th>
<th>PRN or STAT dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine and Diamorphine</td>
<td>Pain, Dyspnoea</td>
<td>Strong opioids commonly cause: Nausea and vomiting, drowsiness/sedation, constipation, dry mouth</td>
<td>Titrate dose to patients pain. Refer to Converting to a Syringe Driver. For opioid naïve patients start with 5-10mg over 24 hours. No max dose limit.</td>
<td>1/6th of total daily dose max hourly PRN</td>
</tr>
<tr>
<td>Diamorphine is preferred if higher doses required due to its greater solubility. If known renal impairment (eGFR&lt;30ml/min) use fentanyl or alfentanil instead.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxycodone</td>
<td>Pain (Usually reserved for patients intolerant of other strong opioids such as morphine)</td>
<td>See morphine and diamorphine</td>
<td>Titrate dose to patients pain. Refer to Converting to a Syringe Driver. For opioid naïve patients start with 7.5mg over 24 hours. No max dose limit.</td>
<td>1/6th of total daily dose max hourly PRN</td>
</tr>
<tr>
<td>If known renal impairment (eGFR&lt;30ml/min) use fentanyl or alfentanil instead.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclizine</td>
<td>Nausea and vomiting</td>
<td>Antimuscarinic side effects including: Drowsiness, dry mouth, blurred vision. Can cause local skin irritation. May crystallise.</td>
<td>100-150mg over 24 hours</td>
<td>50mg PRN up to three times daily. Use another antiemetic if already on maximum daily dose.</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>Nausea and vomiting (useful in gastric stasis and functional bowel obstruction) Do not use in complete bowel obstruction</td>
<td>Parkinsonian side effects</td>
<td>30-100mg over 24 hours</td>
<td>10mg</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>Nausea and vomiting</td>
<td>Parkinsonian side effects</td>
<td>Nausea and vomiting: 2.5-500 micrograms – 1mg PRN</td>
<td></td>
</tr>
<tr>
<td>Drug</td>
<td>Agitation</td>
<td>Akathisia</td>
<td>Sedation</td>
<td>Dosing of Agitation/Other</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Long half-life and can be given as once daily SC injection</td>
<td><strong>Agitation</strong></td>
<td><strong>Akathisia</strong></td>
<td><strong>Sedation</strong></td>
<td>10mg over 24 hours <strong>Agitation:</strong> 5-15mg over 24 hours</td>
</tr>
<tr>
<td>Levomepromazine</td>
<td>Nausea and vomiting Agitation</td>
<td>Postural hypotension Antimuscarinic side effects including: Drowsiness, dry mouth, blurred vision Can reduce seizure threshold</td>
<td>Nausea and vomiting: 5-25mg Agitation: 12.5–100mg over 24 hours Specialist supervision needed with doses over 100mg</td>
<td>Nausea and vomiting: 2.5-6.25mg Agitation: 6.25mg – 50mg</td>
</tr>
<tr>
<td>Midazolam</td>
<td>Terminal agitation Respiratory panic Severe anxiety Anti-convulsant</td>
<td>Drowsiness, cognitive impairment, unsteadiness</td>
<td>Terminal agitation and breathlessness: 10-60mg over 24 hours Consider introducing antipsychotic e.g. haloperidol before increasing above 30mg for terminal agitation <strong>Anti-convulsant:</strong> initially 20-40mg over 24 hours</td>
<td>Terminal agitation and breathlessness: 2.5-10mg max hourly PRN <strong>Anti-convulsant:</strong> 10mg</td>
</tr>
<tr>
<td>Hyoscine Butylbromide (Buscopan)</td>
<td>Helps dry bronchial secretions (death rattle) Reduce bowel colic (large volume vomits)</td>
<td>Antimuscarinic side effects including: Drowsiness, dry mouth, blurred vision</td>
<td>Noisy respiratory secretions: 20-120mg over 24 hours <strong>Bowel colic:</strong> 60-300mg over 24 hours</td>
<td>20mg max hourly PRN</td>
</tr>
<tr>
<td>Hyoscine Hydrobromide</td>
<td>Helps dry bronchial secretions (death rattle) Reduce bowel colic (large volume vomits)</td>
<td>Crosses blood-brain barrier so usually sedative and occasionally causes paradoxical agitation Antimuscarinic side effects including: Drowsiness, dry mouth, blurred vision</td>
<td>1.2-2mg over 24 hours</td>
<td>400 micrograms</td>
</tr>
<tr>
<td>Glycopyronium</td>
<td>Helps dry bronchial secretions (death rattle) Reduce bowel colic (large volume vomits)</td>
<td>Antimuscarinic side effects including: Drowsiness, dry mouth, blurred vision</td>
<td>600-1200 micrograms over 24 hours</td>
<td>200 micrograms</td>
</tr>
</tbody>
</table>
### 24. Drugs to be used only on the recommendation of a palliative care specialist

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Indications</th>
<th>Potential adverse effects</th>
<th>Usual dose range</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fentanyl</strong></td>
<td>Pain</td>
<td>Strong opioids commonly cause: Nausea and vomiting, drowsiness/sedation, constipation, dry mouth</td>
<td>Titrate dose to patients pain or dose conversion from a palliative care specialist. No max dose limit.</td>
<td>Seek advice from a palliative care specialist</td>
</tr>
<tr>
<td><strong>Alfentanil</strong></td>
<td>Pain</td>
<td>See fentanyl</td>
<td>Titrate dose to patients pain or dose conversion from a palliative care specialist. No max dose limit.</td>
<td>Seek advice from a palliative care specialist. STAT doses have a very short duration of action (about 30 mins) so frequent dosing may be necessary. Review daily.</td>
</tr>
<tr>
<td><strong>Ketamine</strong></td>
<td>Difficult pain, usually reserved for patients with pain unresponsive to standard treatments or for intractable neuropathic pain</td>
<td>Agitation, vivid dreams/hallucinations, hypertension, tachycardia</td>
<td>Titrate dose to patients pain or dose conversion from a palliative care specialist.</td>
<td>Dilute with saline. Seek advice on drug compatibility from a palliative care specialist.</td>
</tr>
<tr>
<td><strong>Octreotide</strong></td>
<td>Reduces gastrointestinal secretions e.g. vomiting in bowel obstruction, discharge from fistulae, profuse diarrhoea</td>
<td>Dry mouth, nausea, abdominal pain, urinary retention, bradycardia, tachycardia, hyperglycaemia/hypoglycaemia</td>
<td>Initially 250-500 micrograms over 24 hours</td>
<td>Compatible with Diamorphine</td>
</tr>
<tr>
<td><strong>Dexamethasone</strong></td>
<td>Cerebral oedema, Bowel obstruction, Nausea and vomiting</td>
<td>Insomnia, dyspepsia, delirium</td>
<td>4-16 mg over 24 hours. Doses of up to 8 mg can be given as STAT subcutaneous injections.</td>
<td>Consider separate subcutaneous injection to avoid precipitation. Precipitates with many other drugs. Seek advice from a palliative care specialist.</td>
</tr>
<tr>
<td><strong>Phenobarbital</strong></td>
<td>Anti-convulsant (when midazolam not available)</td>
<td>Respiratory depression (high doses), drowsiness</td>
<td>200-400 mg over 24 hours. Dilute each 200 mg vial with starke.</td>
<td>Do not mix with other drugs.</td>
</tr>
<tr>
<td>effective)</td>
<td></td>
<td>10ml water for injection to avoid tissue necrosis.</td>
<td>Stat doses should be given intravenously (large volume once diluted) and must be diluted in water for injection</td>
<td></td>
</tr>
</tbody>
</table>
### Equality Impact Assessment

#### Section 1: Initial Assessment

<table>
<thead>
<tr>
<th>Policy Author</th>
<th>Date of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice Education Facilitator, Syringe Pump Training</td>
<td>June 2016</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title of Policy</th>
<th>Is this a new or existing policy?</th>
</tr>
</thead>
<tbody>
<tr>
<td>McKinley T34 Syringe Pump Policy &amp; Procedure</td>
<td>Existing</td>
</tr>
</tbody>
</table>

1. Briefly describe the aims, objectives and purpose of the Policy / Guidance Document:

   This policy has been developed to inform employees of North Somerset Community Partnership on the safe use of the McKinley T34 Syringe pump and the management of activities involving medications with the aim of maintaining the safety of both patients and staff.

2. Who is intended to benefit from the proposed process and in what way?

   Staff – to provide guidance on safe use of medicines
   Organisation – to provide assurance framework for safe use of the Mckinley T34 syringe pump and medicines and comply with CQC standards (outcome 9)
   Patients – to provide safeguards for the safe use of the Mckinley T34 syringe pump and medicines

3. Who are the main stakeholders in relation to this Policy/Guidance?

   Staff, organisation, patients

4. Are there concerns that the Policy/Guidance does, or could have, a differential impact due to any of the equality areas?
(Y/N – delete as appropriate)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>N</td>
</tr>
<tr>
<td>Disability</td>
<td>N</td>
</tr>
<tr>
<td>Gender reassign</td>
<td>N</td>
</tr>
<tr>
<td>Marriage Civil</td>
<td>N</td>
</tr>
<tr>
<td>Partnership</td>
<td>N</td>
</tr>
<tr>
<td>Pregnancy Maternity</td>
<td>N</td>
</tr>
<tr>
<td>Race</td>
<td>N</td>
</tr>
<tr>
<td>Religion Belief</td>
<td>N</td>
</tr>
<tr>
<td>Sex</td>
<td>N</td>
</tr>
<tr>
<td>Sexual orientation</td>
<td>N</td>
</tr>
</tbody>
</table>

5. What existing evidence (either presumed or otherwise) do you have for this?

All staff are trained and competency assessed on the safe use of the McKinley T34 syringe pumps. Staff are not permitted to set up and maintain McKinley T34s without this. Community Teams and the Training department hold a record of all those that have been assessed as competent. All patients are treated based upon their symptoms alone.

6. Based on the answers given in questions 4 & 5 is there potential for an adverse impact in this policy/guidance?

No; This guidance is intended to improve safety in line with CQC outcome 9 and to aid implementation of recommendations from the National Patient Safety Agency and MHRA.

7. Can this adverse impact be justified?

N/A

If you have not identified adverse impact or you can justify the adverse impact, finish here.

If you have identified adverse impact that cannot be justified, please continue to Section 2

Section 2: Full Impact Assessment

8. What experts/relevant groups have you approached to explore their views on the issues? Please list the relevant group/experts, how they were consulted and when.

Relevant groups/experts
How were the views of these groups obtained?  

Date contacted

9. Please explain in detail the views of these groups/experts on the issues involved:

10. Taking into account the views of the groups/experts and the available evidence, what are the risks associated with the policy, weighed against the benefits of the policy if it were to stay as it is:

<table>
<thead>
<tr>
<th>Risks</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you have found that the risks outweigh the benefits you need to review the policy further and put together an implementation plan which clearly sets out any actions you have identified as a result of undertaking the EIA. These may include actions that need to be carried out before the EIA can be completed or longer-term actions that will be carried out as part of the policy or development.

11. Monitoring arrangements and scheduled date to review the policy and Equality Impact Assessment:

<table>
<thead>
<tr>
<th>Review Date</th>
<th>June 2018</th>
</tr>
</thead>
</table>