

Multiple Concurrent Infusions for Home Parenteral Support Patients

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Aim

This article aims to provide clarity on the limitations of dual or triple concurrent infusions from different pump types and support nutrition teams in assessing the suitability of Multi - Chambered Bags (MCBs) and / or IV fluid regimens for individual patients.

Due to current prescribing practices, this guidance is primarily aimed at adult nutrition teams, though it may also be relevant to paediatric teams where these systems are in use.

The growing demand for aseptic compounding capacity and the increasing use of Multi-Chambered Bags, IV fluids, and IV micronutrient infusions for clinically suitable Home Parenteral Support (HPS) patients (NHS England, 2023) have driven changes in how these infusions are managed in a homecare setting.

To support these developments, ambulatory pump manufacturers have introduced infusion sets and / or pumps designed to enable concurrent infusions. While these solutions offer efficiencies, they also present limitations, which this article will explore in detail.

A critical factor in administering concurrent infusions is pharmaceutical compatibility. The practicalities of using infusion sets must be carefully considered, as incompatible combinations may lead to:

- Precipitation and catheter occlusion.
- Increased risk of embolisation.

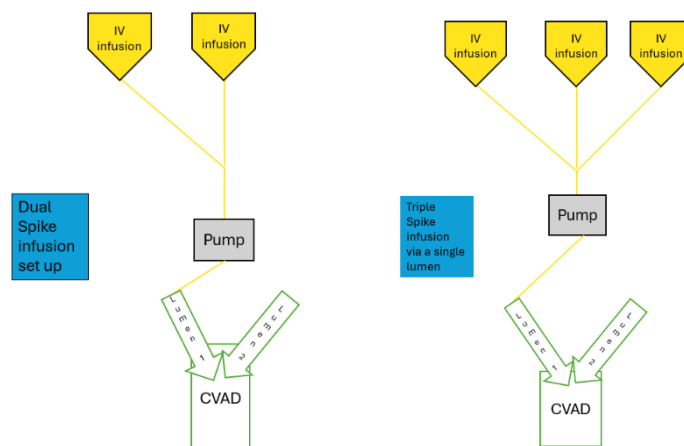
To ensure patient safety, pharmacy teams must always confirm compatibility before initiating concurrent infusions.

Dual and Triple Spike Infusions

Some pump manufacturers have developed systems where dual or triple spike administration sets merge before entering the pump, combining fluids into a single line that connects to the patient's Central Venous Access Device (CVAD).

These systems are two - component devices that require assembly before use and involve in - line mixing (Bentley et al., 2015).

Dual (Left) and Triple (Right) spike infusions attached to a single lumen on a CVAD



Key Considerations for Dual and Triple Spike Infusions

When using these systems, all components infused concurrently must:

- Be pharmaceutically compatible for in - line mixing.
- Be administered at the same infusion rate.
- Have a total volume programmed into the pump.

The pump will treat the combined fluids as a single bag, meaning that while practical measures can be taken to encourage even fluid distribution, there is no guarantee that both fluids will be pulled at the same rate. This could lead to inconsistent dosing, where the patient may not receive the correct volume of each infusion fluid.

For this reason, dual or triple spike systems are not recommended in the following scenarios:

- When Bag A requires full infusion, but Bag B requires only a partial infusion.
- When either drug must be administered at an exact hourly rate for safety reasons (e.g., potassium infusions).
- When the drugs are pharmaceutically incompatible and cannot be safely mixed in - line.

Alternative Approach: Dual - Chamber Pumps

Some pump manufacturers offer dual - chamber pumps, which are designed to administer two separate infusions simultaneously through independent channels. These systems use two separate administration sets, meaning the patient will need to have the lines connected to either:

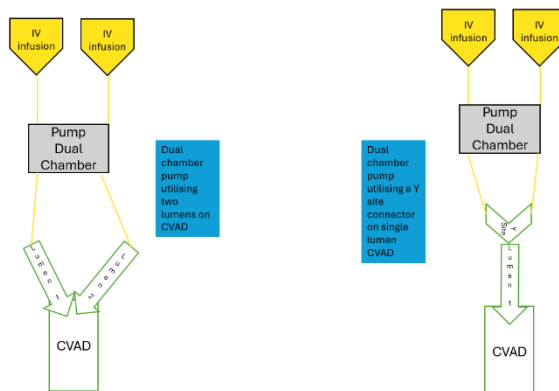
- a) Two individual lumens on their CVAD, or
- b) A Y - site connector attached to the CVAD to allow both administration sets to be connected to a single lumen.

A Y - site connector is typically used when the patient has:

- A single - lumen CVAD.
- A secondary lumen dedicated to another therapy, such as chemotherapy.

Note: If a Y - site connector is used, in - line mixing will still occur, but this will be limited to the fill volume of the Y - site and CVAD lumen. Therefore, Y - site compatibility of the two infusion fluids must be confirmed by the pharmacy team before proceeding. Additionally, any potential risks associated with Y - site use should be carefully considered in advance.

Dual chamber pump connected to two separate lumens (Left) and a Y-site connector (Right)



Using a Y - Site for Concurrent Infusions

When a Y - site connector is used, in - line mixing will occur, but this will be limited to the combined fill volume of the Y - site and CVAD lumen.

This system should only be used if the Y - site compatibility of both infusion fluids has been confirmed by the pharmacy team to ensure patient safety.

When a Secondary Pump May Be Required

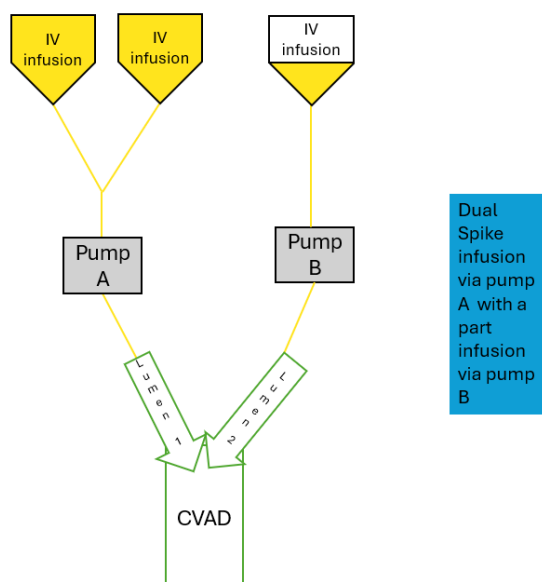
In some cases, the complexity of a patient's prescription may require an additional pump.

For example:

- Drugs A and B require full infusions, but Drug C only requires a partial infusion.

In such scenarios, a secondary pump may be needed to ensure accurate dosing and administration times.

**Dual spike infusion administered via pump A (Left)
and a partial infusion administered via pump B
(Right)**



General Considerations for Multiple Concurrent Infusions

Introducing multiple concurrent infusions adds complexity to a patient's Home Parenteral Support (HPS) regimen. Key factors to assess include:

- Patient training for independence.
- Patient's strength and dexterity.
- Line type.
- Additional connectors required.
- In - line mixing considerations.
- Increased line manipulation, which raises the risk of complications, such as infection.

Training and Support Needs

Manipulating Multi-Chambered Bags (MCBs) and / or preparing additional IV vitamins requires a certain level of strength and dexterity. Some patients may not be able to manage these tasks independently.

In such cases, training additional support individuals – such as relatives, friends, or carers – should be considered to ensure safe and effective administration.

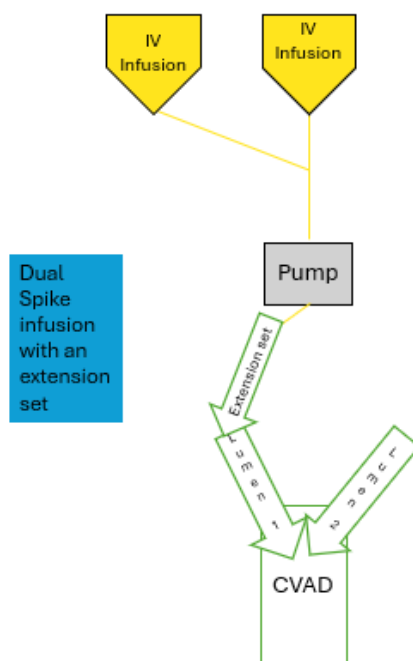
Use of Extension Sets for Independent Management

Patients training for independent management with a Peripherally Inserted Central Catheter (PICC) will require an extension set to facilitate self - administration.

However, this:

- Adds additional connections to the patient's infusion setup.
- Increases the number of key components in the HPS regimen.
- Introduces additional complexity and potential risk factors, which should be carefully assessed before implementation.

Dual spike infusion administered via an extension set on a CVAD



Considerations for Patients Using Two Pumps

For patients requiring two pumps, careful consideration must be given to how they will safely mobilise with these at home. Key factors include:

- Method of carrying – Do they use rucksacks or drip stands?
- Equipment fit – If using a rucksack, will multiple pumps fit securely?

- Weight implications – What is the combined weight of their PN, pumps, and rucksacks?
- Home environment – Does the home layout require movement between floors, and can this be safely managed?

These factors must be assessed on an individual basis to ensure patients can safely and comfortably manage their infusions at home.

Prescription Wording for Identifying Incompatible Infusion Combinations

Clear prescription wording can help to identify and prevent incompatible drug combinations, reducing risks and improving patient safety. Examples include:

- No in - line mixing – Any medications that must not be infused together within the same administration set or CVAD lumen.
- Drug A to be administered concurrently with Drug B – Clarifies which medications can be safely infused together.
- Drug C to be administered concurrently with either Drug A or B – Allows flexibility while ensuring compatibility.

Conclusion

Advancements in managing multiple concurrent infusions have supported improvements in prescribing practices and aseptic compounding capacity. These developments enable patients to manage their infusions without the need for refrigeration, reducing complexity and improving convenience.

However, limitations remain, and individual patient needs must be carefully assessed. This article is not an exhaustive guide—homecare teams should provide specialist guidance on pump types and suitability based on a patient - specific assessment.

Pump brand recommendations should always be based on clinical need.

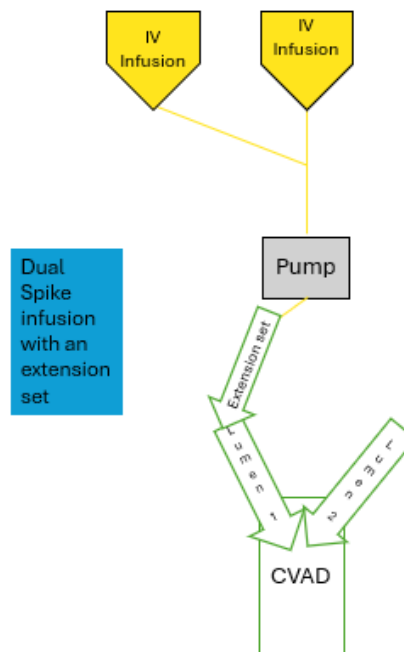
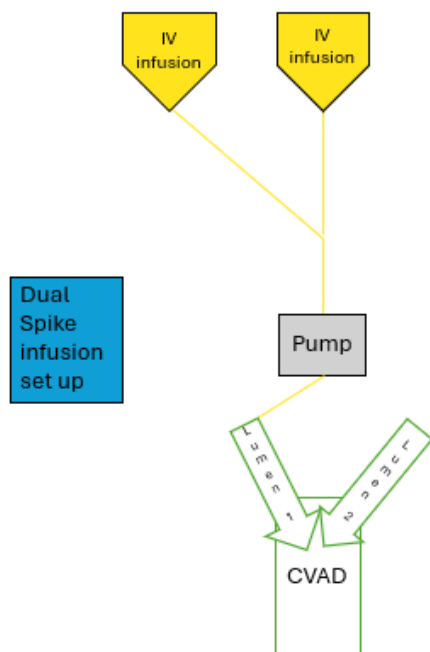
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Glossary of Terms

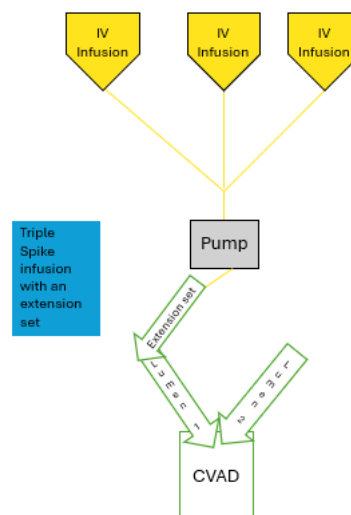
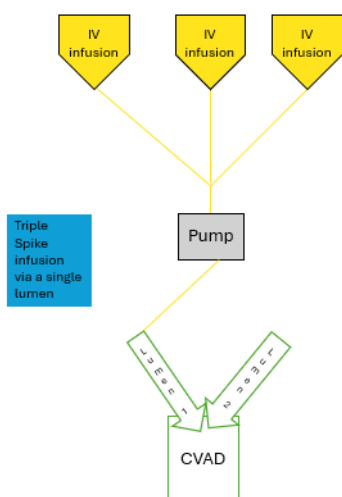
- Compounded / Compounding – The production of a bespoke parenteral nutrition bag for a patient, created in a specialist aseptic unit under strict conditions. These infusions have variable stability depending on formulation and must be stored between 2 - 8°C when not in use.
- CVAD (Central Venous Access Device) – A general term for devices used in parenteral nutrition administration, including:
 - Peripherally Inserted Central Catheter (PICC).
 - Central Venous Catheter (CVC).
 - Implantable Port (Port).
These devices are positioned so that the tip sits in the lower third of the superior vena cava.
- Extension Set – An attachment that lengthens PICC lines to support patient independence. These connect directly to the CVAD and vary in length. Some include built - in needle - free connectors, while others require them to be added separately.
- Home Parenteral Support (HPS) – Also referred to as Home Parenteral Nutrition (HPN), this refers to parenteral treatments provided in a community setting through homecare providers commissioned on NHS frameworks.
- In - Line Mixing – Occurs when the contents of two infusion bags mix within the administration set, before entering the patient's line.
- Multi - Chambered Bags (MCB) – Provide ambient - stable parenteral nutrition before mixing, but are not individually tailored to a patient's needs. These bags require manual activation to combine the individual chambers before administration.
- Y - Site Connector – A connector that attaches directly to a patient's CVAD, providing additional infusion connection points while ensuring medications are delivered through the same lumen.
 - Y - site connectors can be dual or triple.
 - Some include built - in needle - free connectors, while others require them to be added separately.
 - Compatibility with infused medications must be confirmed before use.

Appendix A: Combinations of managing multiple concurrent infusions

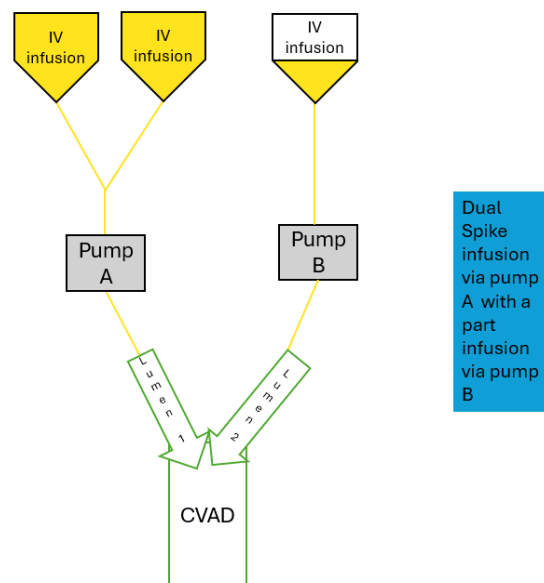
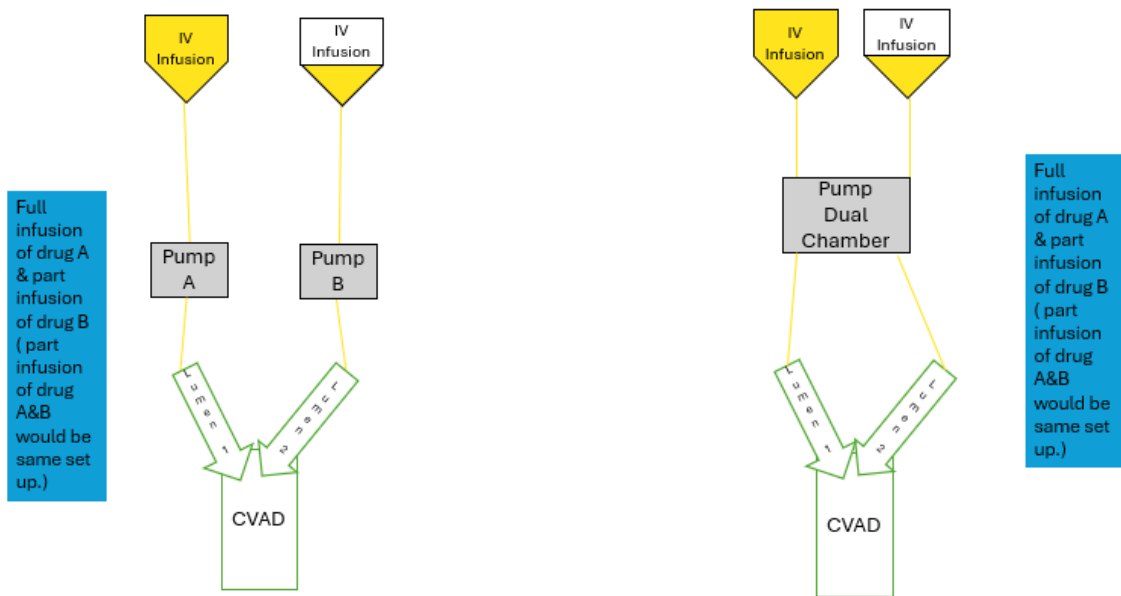
Dual spike infusion (full bags)



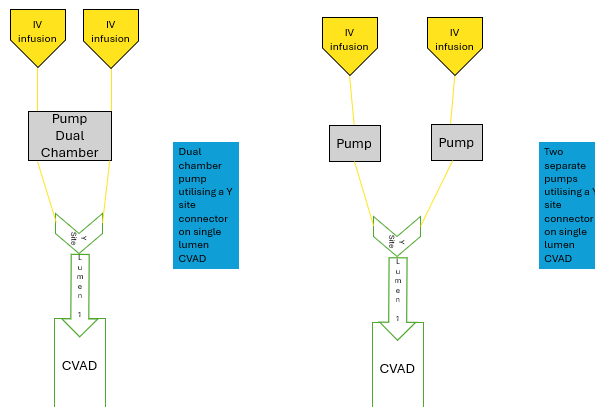
Triple spike infusion (full bags)



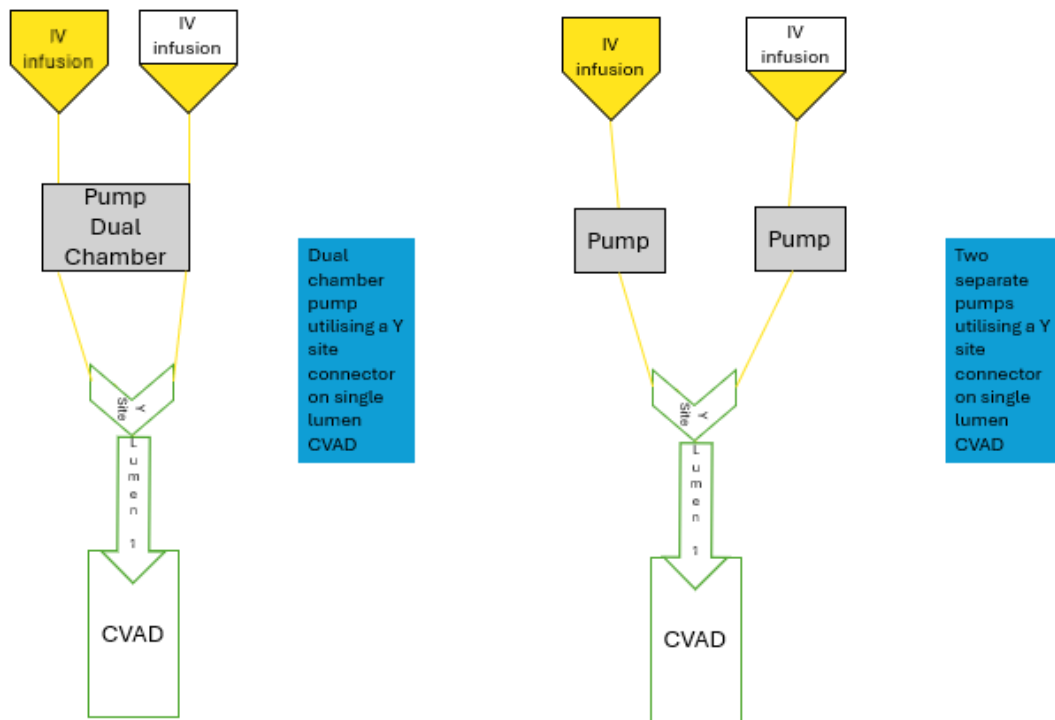
Part infusions



Y site variations (full bags)



Y site variations (Part bags)



References

- NHS England (2023), *Parenteral nutrition for the treatment of adults and children with Type 2 and Type 3 intestinal failure requiring home parenteral support*. Available at: [NHS England » Clinical commissioning statement: parenteral nutrition for the treatment of adults and children with type 2 and type 3 intestinal failure requiring home parenteral nutrition](#) (Accessed: 12 May 2024)
- Bentley, J., Heard, K., Collins, G. and Chung, C., 2015. Mixing medicines: how to ensure patient safety. *Pharm J*, 294(7859), pp.453-456.