



Everything you need to know about air bubbles in your patient's IV line.

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How do we prevent them? How do we get rid of them? And do we need to worry about them in the first place?

In most cases, it will require at least 50 mL of air to result in significant risk to life, however, there are case studies in which 20 mLs or less of air *rapidly* infused into the patient's circulation has resulted in a fatal air embolism.

So, you can be assured that it usually requires a large volume of air in the line to produce a life-threatening risk of air embolism. Much more than we see typically see with those small air bubbles appearing in the IV line.

However, even very small amounts of air, known as *micro-bubbles* have the potential to migrate through the chambers of the heart and lodge in the pulmonary vascular

bed. This is not usually a problem as they are readily absorbed, but if large numbers *rapidly* accumulate they may merge into larger emboli and present a risk. This is of particular note in older patients and those with underlying co-morbidities.

So... we should not be overly alarmed with small air bubbles (which often appear mysteriously) in the line, **but** we should not be complacent. We should always attempt to minimise the risk of them forming.

Make sure you have primed the drip chamber.

Sounds obvious, but failure to adequately prime the drip chamber (which are usually marked with a fill line) will increase the likelihood of air bubbles making their way into the IV line. Especially if running at faster rates or with a shallow-fill of the drip chamber.

Make sure you have actually primed the line.

When hanging an IV bag it is not so unusual to be interrupted with the risk of forgetting to fully prime the tubing. It can be difficult to tell if the IV tubing is full of fluid or air on a quick glance, so always double check.

Never leave a spiked but un-primed IV line hanging on an IV pole.

An un-primed IV line presents a potential for a more significant volume of air to be accidentally infused into the patient's circulation.

Always close the roller clamp before changing bags.

Air may enter the IV line during regular bag changes and be flushed into the circulation with the new bag. Close the roller clamp, even if you think it is going to be a quick changeover.

Do not add air to the IV bag when injecting additives.

Make sure there is no extra air injected into the IV bag when adding medications or electrolytes etc. The extra pressure may exceed atmospheric within the bag, allowing air to continue to infuse into the patient once the bag is empty (if gravity fed).

For the same reason, a bag that has been disconnected from the IV set should never be re-connected, as any extra air that may enter the flask could lead to embolism.

Don't put the bag on the bed.

There is no surer way to get air in your IV line than to follow the practice of putting the patients IV bag down next to them on the bed (when, for example, transferring them from one bed to another).

Always ensure the bag is hanging vertically.

A jiggling bag will blow bubbles.

Bags that are jiggling around on their IV poles (for example during bed transport along uneven floors) may produce bubbles.

Be extra bubble aware on gravity feed lines.

Most, if not all, IV pumps have some form of bubble detection system these days. And whilst annoying most of the time, they are effective. When giving IV fluids *without* a pump take extra care.

When infusing without a pump and using a pressure bag be super-careful.

Expel all the air from syringes when injecting into line.

Self-obvious. But again, it's easy to become distracted and end up with a few mLs of air in your syringe.

Keep the IV bung snug.

Finally, make sure the IV bung is not loose on the patient's cannula. I have often witnessed large amounts of air *entrained* from around a loose bung and drawn up into the syringe when taking blood samples.

I imagine there is a possibility of this working the other way around when infusing fluids through a poorly connected bung.

OK. I have a bubble. Now what?

I really wouldn't worry too much about those individual small bubbles. But for larger ones (where it becomes more of a 'gap' in the fluid than a bubble), or multiple bubbles, we should remove them.

There are several ways to remove air bubbles from the IV lines. All are annoying. Even so, do not be lazy and attempt to just purge or bypass the bubble detector and then resume the infusion.

Flick and float.

Usually effective for removing small bubbles that have triggered the IV pump to alarm.

1. Stop the infusion. **Clamp the line below the IV pump.**
Or move the roller clamp down the tubing as far as you can and then clamp this.
2. Remove the tubing from the pump.

3. Holding the IV line taught, repeatedly flick the line with your fingernail at the level of the bubble, *floating* it up the line.
4. Once the bubble is near the top of the tubing you can place your pen further down the tubing and wrap the line tightly around it, forcing the bubble up into the drip chamber.
5. Once the bubble is cleared, *gently* unwrap the line from your pen and reconnect to the pump. Un-clamp and recommence the infusion.

Purge.

1. Stop the infusion. Clamp the line and remove from the pump.
2. Ensuring clean technique, disconnect the line from the patient's cannula and then run enough fluid through to flush out the bubble.
Watch the bubble chamber to make sure you are not drawing in more bubbles as you do this.
3. Reconnect the IV line and re-establish the infusion.

Syringe method.

Many IV lines have a 'Y' injection port at the distal end. By attaching a 10 or 20mL syringe to this port you can draw the air bubble into it without having to disconnect the IV line or remove it from the pump.

However, I advise caution using this method as it involves purging the bubble right down towards the cannula. Ensure that the IV line is well clamped & that you do not inadvertently add air from the syringe.

1. Stop the infusion.
2. Clamp the line just above the cannula (and below the Y-connector).
3. Attach the syringe
4. Recommence the infusion and draw fluid into the syringe until the air bubble is captured. When using a pump, you will usually not need to draw back on the syringe – it will push the fluid into it.
5. Remove syringe & clamp and re-commence infusion.

Signs & Symptoms of air emboli.

The most common symptoms are sudden onset of breathlessness, nausea, shoulder and chest pain. Expressions of anxiety or feelings of *impending doom* are also common.

Clinical symptoms of air embolism		
Anxiety	Tachycardia	Dyspnoea
Chest pain	Tachypnoea	Chest pain
Altered LOC	Agitation	Hypotension/shock
SOB	Cyanosis	Sudden LOC

Initial management.

Immediate treatment of suspected air embolism	
Place patient in left sided Trendelenburg position (if not contraindicated)	
Administer high flow O ₂	Monitor vital signs.
Activate immediate medical review	

The theory is that by placing the patient tilted head down, any air entering the heart is trapped in the apex of the right atrium and prevented from entering the pulmonary artery. If the patient will not tolerate the Trendelenburg position the left lateral decubitus (lying flat) can be used.

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