

CLAIMS

We claim:

1. A catheter extension set, comprising:
a distal end, comprising a luer adapter configured to couple to a catheter adapter;
a proximal end, comprising a blood collection device; and
an extension tube extending between the distal end and the proximal end.
2. The catheter extension set of claim 1, further comprising a clamp disposed on the extension tube, wherein the clamp is configured to move between a clamped position and an unclamped position.
3. The catheter extension set of claim 1, wherein the luer adapter is a first luer adapter, wherein the blood collection device comprises a second luer adapter, further comprising a third luer adapter coupled to the second luer adapter, wherein the extension tube comprises a distal end and a proximal end, wherein the distal end of the extension tube is integrated with the first luer adapter, wherein the proximal end of the extension tube is integrated with the third luer adapter.
4. The catheter extension set of claim 1, wherein the extension tube comprises a distal end and a proximal end, wherein the distal end of the extension tube is integrated with the luer adapter, wherein the proximal end of the extension tube is integrated with the blood collection device.
5. The catheter extension set of claim 1, wherein an inner surface of the extension tube comprises an absorbent material or an indicator tube comprising a plurality of markers, wherein blood within the extension tube is configured to flow proximate the absorbent material or through the indicator tube.

6. A catheter extension set, comprising:
 - a distal end, comprising a luer adapter configured to couple to a catheter adapter;
 - a proximal end, comprising a blood collection device;
 - a first extension tube extending between the distal end and the proximal end; and
 - a second extension tube extending between the distal end and the proximal end.
7. The catheter extension set of claim 6, further comprising a clamp, wherein the second extension tube extends through the clamp, wherein the clamp is configured to move between a clamped position and an unclamped position.
8. The catheter extension set of claim 7, wherein the first extension tube is longer than the second extension tube.
9. The catheter extension set of claim 7, wherein an inner diameter of the first extension tube is less than an inner diameter of the second extension tube.
10. The catheter extension set of claim 7, wherein an inner surface of the first extension tube comprises an absorbent material or an indicator tube comprising a plurality of markers, wherein blood within the extension tube is configured to flow proximate the absorbent material or through the indicator tube.
11. The catheter extension set of claim 7, wherein the first extension tube is disposed within the second extension tube, wherein in response to the clamp being in the clamped position, blood flows through the first extension tube and blood flow between an outer surface of the first extension tube and an inner surface of the second extension tube.
12. The catheter extension set of claim 5, wherein the luer adapter is a first luer adapter, wherein the blood collection device comprises a second luer adapter, further comprising a third luer adapter coupled to the second luer adapter, wherein the first

extension tube comprises a distal end and a proximal end, wherein the second extension tube comprises a distal end and a proximal end, wherein the distal end of the first extension tube and the distal end of the second extension tube are integrated with the first luer adapter, wherein the proximal end of the first extension tube and the proximal end of the second extension tube are integrated with the third luer adapter, wherein in response to the second luer adapter being tightened with respect to the third luer adapter, a first fluid pathway through the first extension tube is open and a second fluid pathway through the second extension tube is closed, wherein in response to the second luer adapter being loosened with respect to the third luer adapter, the first fluid pathway through the first extension tube is open and the second fluid pathway through the second extension tube is open.

13. The catheter extension set of claim 5, further comprising a pressure-sensitive valve within a fluid pathway of the catheter extension distal to the first extension tube and the second extension tube, wherein in response to a first predetermined vacuum pressure level within the catheter extension set, the pressure-sensitive valve is open with respect to the first extension tube and closed with respect to the second extension tube, wherein in response to a second predetermined vacuum pressure level within the catheter extension set, the pressure-sensitive valve is closed with respect to the first extension tube and open with respect to the second extension tube, wherein the first predetermined vacuum pressure level is greater than the second predetermined vacuum pressure level.
14. The catheter extension set of claim 5, wherein the second extension tube comprises a pressure-sensitive valve.

15. A method of blood collection, comprising:

inserting a catheter of a catheter system into vasculature of a patient, wherein the catheter system comprises:

a catheter adapter;

the catheter extending distally from the catheter adapter;

coupling a catheter extension set to the catheter adapter, wherein the catheter extension set comprises:

a distal end, comprising a luer adapter configured to couple to a catheter adapter;

a proximal end, comprising a blood collection device, wherein the blood collection device comprises a needle configured to receive a blood collection container;

a first extension tube extending between the distal end and the proximal end; and

a second extension tube extending between the distal end and the proximal end;

blocking blood flow through the second extension tube;

after inserting the catheter of the catheter system into the vasculature of the patient, coupling the catheter extension set to the catheter adapter, and blocking blood flow through the second extension tube, coupling a blood collection container to the blood collection device, wherein in response to coupling the blood collection container to the blood collection device, the blood collection container begins to fill with blood;

in response to the blood collection container filling partially with blood, opening the second extension tube such that increased blood flows through the second extension tube.

16. The method of claim 15, wherein a flow resistance of the first extension tube is greater than a flow resistance of the second extension tube.

17. The method of claim 15, wherein the catheter system further comprises a clamp, wherein the second extension tube extends through the clamp, wherein the clamp is configured to move between a clamped position and an unclamped position, wherein blocking blood flow through the second extension tube comprises moving the clamp to the clamped position, wherein opening the second extension tube comprises moving the clamp to the unclamped position.
18. The method of claim 15, wherein the catheter system further comprises a roller clamp, wherein the roller clamp comprises a roller moveable within a track, wherein the first extension tube and the second extension tube extend through the roller clamp generally perpendicular to the track, wherein when blood flow through the second extension tube is blocked, the roller is disposed in a first position proximate the second extension tube, wherein opening the second extension tube comprises moving the roller along the track away from the second extension tube and toward the first extension tube.
19. The method of claim 15, wherein the luer adapter is a first luer adapter, wherein the blood collection device comprises a second luer adapter, further comprising a third luer adapter coupled to the second luer adapter, wherein the first extension tube comprises a distal end and a proximal end, wherein the second extension tube comprises a distal end and a proximal end, wherein the distal end of the first extension tube and the distal end of the second extension tube are integrated with the first luer adapter, wherein the proximal end of the first extension tube and the proximal end of the second extension tube are integrated with the third luer adapter, wherein blocking blood flow through the second extension tube comprises tightening the second luer with respect to the third

luer adapter, wherein opening the second extension tube comprises loosening the second luer with respect to the third luer adapter.

20. The method of claim 15, wherein the distal end of the catheter extension set comprises a three-way stopcock having a first port, a second port, and a third port, wherein the first extension tube is coupled with the first port, the second extension tube is coupled to the second port, and the third port comprises the luer adapter configured to couple to the catheter adapter, wherein blocking blood flow through the second extension tube comprises rotating the three-way stopcock to a first position, wherein opening the second extension tube comprises rotating the three-way stopcock to a second position.

21. A catheter extension set, comprising:

a distal end, comprising a luer adapter configured to couple to a catheter adapter;

a proximal end, comprising another luer adapter configured to couple to a blood collection device; and

an extension tube extending between the distal end and the proximal end, wherein a geometric factor G_f of the extension tube is equal to or greater than a predetermined value to reduce hemolysis.

22. The catheter extension set of claim 21, wherein the catheter extension set is configured for use with an 18G catheter, wherein the geometric factor G_f of the extension tube is equal to or more than $3.83\text{E}+06$ ($1/\text{in}^3$).

23. The catheter extension set of claim 21, wherein the catheter extension set is configured for use with an 20G catheter, wherein the geometric factor G_f of the extension tube is equal to or more than $3.27\text{E}+06$ ($1/\text{in}^3$).

24. The catheter extension set of claim 21, wherein the catheter extension set is configured for use with an 22G catheter, wherein the geometric factor G_f of the extension tube is equal to or more than $3.33\text{E}+06$ ($1/\text{in}^3$).
25. The catheter extension set of claim 21, wherein the catheter extension set is configured for use with an 24G catheter, wherein the geometric factor G_f of the extension tube is equal to or more than $1.50\text{E}+07$ ($1/\text{in}^3$).