We claim:

1. A method of determining the cardiac output of a heart, comprising

applying hemodynamic support to the heart via a blood pump, the hemodynamic support comprising pumping blood at a first pumping rate during a plurality of beats of the heart, each beat including a systolic rise, a dicrotic notch, and a diastolic fall that occurs after the dicrotic notch;

detecting a first aortic pressure measurement at a first time and a second aortic pressure measurement at a second time, wherein the first time and the second time occur during the diastolic fall of a specific beat of the plurality of beats;

determining a first rate of blood flow pumped by the blood pump at the first time and a second rate of blood flow pumped by the blood pump at the second time; and

determining cardiac output based on the first aortic pressure measurement, the second aortic pressure measurement, the first rate of blood flow, and the second rate of blood flow.

2. The method of claim 1, further comprising:

calculating, using the first aortic pressure measurement the second aortic pressure measurement, the first rate of blood flow, and the second rate of blood flow a time dependent non-linear model of the vascular system to determine systemic vascular resistance and compliance; and

determining cardiac output during the specific beat based on the determined systemic vascular resistance and compliance.

3. The method of claim 2, wherein the time dependent non-linear model is a Windkessel model.

4. The method of claim 2, further comprising determining a first cumulative indicator of cardiac output of the heart.

5. The method of claim 4, wherein determining cardiac output includes: determining a first plurality of cardiac output values, wherein each cardiac output value of the first plurality of cardiac output values corresponds to a respective beat of a first set of beats within the plurality of beats.

6. The method of claim 5, further comprising:

comparing a first cardiac output value to a second cardiac output value, wherein the first plurality of cardiac output values comprises the first and second cardiac output values; determining, based on the comparison between the first cardiac output value and the second cardiac output value, a change in cardiac performance of the heart; and

altering the hemodynamic support to the patient based on the determined change of cardiac performance of the heart over time.

7. The method of claim 5, further comprising applying at least one of a summation, average, or linear regression on the determined plurality of cardiac output values to calculate a first cumulative indicator of cardiac output of the heart.

8. The method of claim 7, wherein the first cumulative indicator of cardiac output of the heart is indicative of cardiac performance of the heart.

9. The method of claim 8, further comprising:

determining a second cumulative indicator of cardiac output of the heart for a second set of beats within the plurality of beats, wherein the second set of beats occurs after the first set of beats;

comparing the first cumulative indicator of cardiac output to the second cumulative indicator of cardiac output;

determining, based on the comparison between the first cumulative indicator and the second cumulative indicator, (i) an increase in cardiac performance of the heart or (ii) a decrease in cardiac performance of the heart; and

altering the hemodynamic support to the patient based on the determined increase or decrease of cardiac performance of the heart over time.

10. The method of claim 9, wherein determining the second cumulative indicator comprises: determining a second plurality of cardiac output values, wherein each cardiac output value of the second plurality of cardiac output values corresponds to a respective beat of the second set of beats; and

applying at least one of a summation, average, or linear regression on the determined plurality of cardiac output values to calculate the second cumulative indicator of cardiac output of the heart.

11. The method of claim 6, wherein determining the cardiac output of the specific beat comprises:

detecting a plurality of aortic pressure measurements at a plurality of times during the diastolic fall of the specific beat, wherein each aortic pressure measurement of the plurality of aortic pressure measurements corresponds to a time of the plurality of times;

determining a plurality of rates of blood flow pumped by the blood pump at the plurality of times;

calculating, using the plurality of aortic pressure measurements and the plurality of rates of blood flow, a plurality of time dependent non-linear models of the vascular system to determine a plurality of systemic vascular resistance and compliance values;

determining a plurality of cardiac output values during the specific beat based on the determined plurality of systemic vascular resistance and compliance values; and

applying at least one of a summation, average, or linear regression to the determined plurality of cardiac output values to calculate the cardiac output of the specific heartbeat.

12. The method of claim 11, further comprising:

determining a second cumulative indicator of cardiac output of the heart for a second heartbeat within the plurality of beats, wherein the second heartbeat occurs after the specific heartbeat;

comparing the first cumulative indicator of cardiac output to the second cumulative indicator of cardiac output;

determining, based on the comparison between the first cumulative indicator and the second cumulative indicator, (i) an increase in cardiac performance of the heart or (ii) a decrease in cardiac performance of the heart; and

altering the hemodynamic support applied based on determining whether cardiac performance of the heart is increasing or decreasing over time.

13. The method of claim 12, wherein hemodynamic support is provided by an intracardiac blood pump that has a cannula configured to be positioned within a ventricle of the heart.

14. The method of claim 13, wherein the cannula is configured to be positioned within a left ventricle.

15. The method of claim 13, wherein a pressure sensor is provided with the intracardiac blood pump, and wherein detecting the plurality of aortic pressure measurements comprises measuring the aortic pressure via the pressure sensor.

16. The method of claim 15, wherein the pressure sensor is positioned within a housing of the blood pump.

17. The method of claim 13, wherein detecting the plurality of aortic pressure measurements comprises receiving the aortic pressure measurements from a pressure sensor separate from the intracardiac blood pump.

18. The method of claim 13, wherein operation of the intracardiac blood pump is adjusted by a controller, and wherein the controller comprises a memory storing the time dependent non-linear model of the vascular system.

19. The method of claim 1, further comprising adjusting the hemodynamic support applied to the heart based on the determined cardiac output.

20. The method of claim 19, further comprising configuring the determined cardiac output for display.

21. The method of claim 20, wherein the systemic vascular resistance and compliance are indicative of resistance and compliance of the aorta.

22. The method of claim 21, wherein determining cardiac output comprises taking an average of total cardiac flow over a period of time.

23. The method of claim 22, wherein the period of time is the length of the specific beat.