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Departmental Policy	Dept.: Intensive Care Services	Policy No:1-2-9451-01-021 Version No: 04		
Title: CARDIAC OUTPUT MEASUREMENT (ADULT)		JCI Code: COP		
Supersedes: 1-2-9451-01-021 Version No. 03;09 September 2020	Issue Date:	Effective Date: 23 OCT 2023	Revision Date: 22 OCT 2026	Page 1 of 6

1. INTRODUCTION

Hemodynamic monitoring provides quantitative information about vascular capacity, blood volume, pump effectiveness, and tissue perfusion. Cardiac output (CO) is an important part of hemodynamic monitoring.

2. APPLICABILITY

CO may be measured in the following areas of ICS: General ICU (GICU), Surgical ICU (SICU), Fast Track, Neurosurgical ICU, Maternity ICU, and Burn ICU.

3. RESPONSIBILITIES

Respiratory Care Services (RCS) staff who has completed the cardiac output measurement and pulmonary artery catheter competencies may perform this procedure.

4. POLICY

- 4.1 The Respiratory Care Practitioner (RCP) will perform the patient's cardiac output (CO), when the patient has pulmonary artery catheter.
- 4.2 Wedge pressure measurement will be taken by the physician.
- 4.3 There must be a written order by a physician before the procedure is carried out.
- 4.4 CO measurement frequency is specified by the Intensive Care Unit (ICU) physician.
- 4.5 Intensive Care Services (ICS) nurses will be responsible for initial preparation of transducer and tubing, monitoring equipment etc..., changing and maintaining pulmonary artery catheter line, dressing, flushing solution, and calibration according to Intensive Care Services policy.

5. DEFINITION OF TERMS

Cardiac Output (CO) is the total amount of blood pumped by the heart per minute. It is also the product of the heart rate (HR) and the volume ejected by the left ventricle on each contraction, or stroke volume.



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6. PROCEDURES

- 6.1 Ensure order for Cardiac input measurement is written by the physician in the patient's chart.
- 6.2 Inspect medical records of patient and reviews history and ensure there are no contraindication for measurement of cardiac output.
- 6.3 Obtain appropriate equipment and supplies.
- 6.4 Correctly identify patient using 2 patient identifiers.
- 6.5 Ensure patient privacy, washes/disinfects hands, and use Personal Protection equipment (PPE).
- 6.6 Introduce self and department. Explain procedure to patient.
- 6.7 Maintain aseptic technique and monitor patient throughout the procedure.
- 6.8 Preferably position patient in supine position, to a maximum. Position patient in the same position each time the measurement is taken and document this position.
- 6.9 Verify catheter position by:
 - 6.9.1 X-ray
 - 6.9.2 Assessment of PA waveform and pressures
 - 6.9.3 Graduation marks on catheter
- 6.10 Check medications/fluids are not infusing through proximal port. Coordinate with the patient's ICU nurse for possibility of temporarily stop such infusions whilst performing the cardiac output study.
- 6.11 Correct level and zero transducers.
- 6.12 At this time the attending ICU physician must be called to bedside to perform measurement of the wedge pressure.

Note: Wedge pressure measurement must be done at end expiration. If the patient is on mechanical ventilation an expiratory pause may be used.
- 6.13 Collect Arterial Blood Gases (ABG) and Mixed Venous Gases (VBG) prior to the cardiac output measurement.
- 6.14 **Connect equipment:**
 - 6.14.1 Module to monitor.



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6.14.2 Bifurcating (transducer) cable to monitor module.

6.14.2.1 Ensure that the Bifurcating (transducer) cable components are attached as follows:

6.14.2.1.1 The temperature probe cable to Normal saline and the Thermistor port to pulmonary artery catheter.

6.14.2.1.2 Ensure that the injectate set is attached to the proximal infusion lumen of pulmonary artery catheter via three way tap.

6.14.2.1.3 Perform wedge measurement by slowly inflating the balloon until the monitor reads WEDGING; maintain inflation until the monitor reads DEFLATE BALOON.

6.14.2.1.4 Allow balloon to deflate spontaneously before proceeding.

6.14.2.1.5 Then syringe should be in “lock off”.

6.14.2.1.6 Ensure patients weight and height are entered into the monitor.

6.14.2.2 To measure cardiac output:

6.14.2.2.1 Turn the three-way tap to open flow between the injectate giving set and the syringe.

6.14.2.2.2 Fill 10 ml syringe with the injectate solution, ensure there are no bubbles.

6.14.2.2.3 Turn three-way tap off to the injectate bag/line, and open flow between syringe and patient.

6.14.2.2.4 Obtain PA pressure, wedge pressure, CVP and arterial pressure measurements prior to cardiac output.

6.14.2.2.5 Press CO on module.

6.14.2.2.6 Press “MEASURE CO”.

6.14.2.2.7 Check injectate temperature is at least 10 degrees lower than the patients’ blood temperature.



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6.14.2.2.8 "READY FOR NEW MEASUREMENT" will then appear.

Press 'START CO'.

6.14.2.2.9 When 'INJECT NOW' appears, injects solution preferably at end expiration

6.14.2.2.10 Inject 10 ml of NaCl rapidly and smoothly. Complete injectate within 4 Seconds.

6.14.2.2.11 At the end of the measurement, the Thermodilution curve, cardiac output, index values and curve alert displayed.

6.14.2.2.12 Wait 1 minute between injections and until the ready signal appears on the monitor.

6.14.2.2.13 Repeat these procedures until a minimum of three measurements are obtained where all are in acceptable limits of error (10%-15%) or a maximum of six measurements.

6.14.2.2.14 Following injections press 'EDIT CO' and discard any inappropriate waveforms and press 'CONFIRM'.

6.14.2.2.15 Ensure that vital parameters correspond with actual values.

6.14.2.2.16 Press 'HEMO CALC', enter in appropriate parameters and then press 'PERFORM CALCS'.

6.14.2.2.17 Record the result.

6.14.2.2.18 Document time of cardiac output measurement and results obtained. Add volume of injectate used to fluid balance chart.

6.14.2.2.19 Document type and dosage of infusions patient is on at the time of doing cardiac output e.g. Inotropes and PEEP set on ventilator.

6.14.2.2.20 Notify physician of any abnormalities/ problems encountered.



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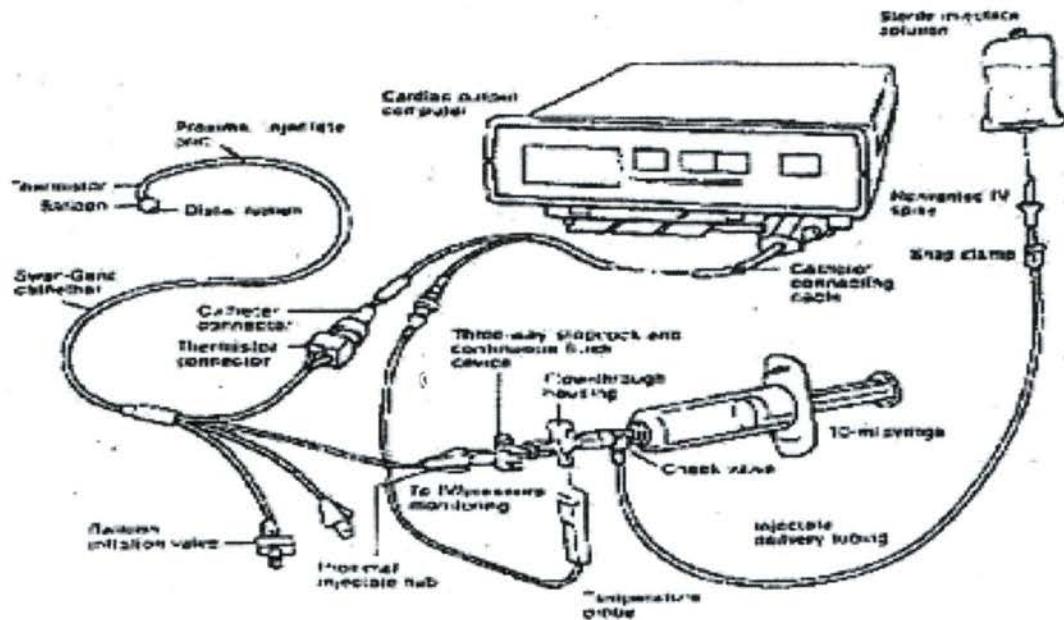
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		Page 5 of 6	

7. REFERENCES

Hemodynamic monitoring, A Bedside Reference Manual DANA F. OAKES 2010 Edition

8. APPENDICES

8.1 Appendix 1: Cardiac Output Measurement Set up



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