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PedCath Formula Reference

Unless noted, references in this chapter are from the following texts:

Yang, Bentivoglio, Maranhao and Goldberg. *From Cardiac Catheterization Data to Hemodynamic Parameters*, third edition. Philadelphia: F.A. Davis Company.

F.B. Saksena. 1983. *Hemodynamics in Cardiology*. Preager.

C. G. LaFarge and O. S. Miettinen, "The estimation of oxygen consumption," *Cardiovascular Research* (1970), no. 4: pages 23-30.

Body Surface Area—Dubois and Dubois height-weight equation

Units: Weight in Kg, Height in cm (Yang et al, page 42.).

$$BSA (cm^2) = Wt^{.425} \times Ht^{.725} \times 71.84$$

Convert BSA (cm²) to BSA (m²):

$$BSA (m^2) = \frac{BSA (cm^2)}{10000} = \frac{BSA (cm^2)}{100 \times 100}$$

O₂ Capacity

The default factor is 1.36 (Yang et al, page 45.).

$$O_2 \text{ Capacity} = HB \times 1.36$$

PedCath uses 1.36 as the default multiplication factor for O₂ Capacity; however, the attending physician may set an alternate multiplier: 1.36 (default), 1.34 or 1.39.

The 1.39 multiplication factor is referenced in Saksena, page 30.

To change the multiplier, you must log in as an administrator and select:
Tools-Options-Administrator-Calculations.

Multipliers are the responsibility of the cath lab medical director.

MV, SA, PA and PV O₂ Content

Referenced as PO₂ x 0.003026 in Yang et al, page 45. **PedCath** rounds to 0.003.

a) If PO₂ not measured:

$$O_2 \text{ Content} = O_2 \text{ Capacity} \times O_2 \text{ sat}$$

b) If PO₂ measured:

$$O_2 \text{ Content} = O_2 \text{ Capacity} \times O_2 \text{ sat} + (.003 \times PO_2)$$

Oxygen Consumption

Two different Oxygen Consumption calculations are available in *PedCath*:

a) Assumed Oxygen Consumption—LaFarge method

Please Note: This method can only be used for patients whose age and heart rate fall within defined limits. Data for gender, heart rate and age are required. Age is calculated as *Cath date - Date of birth*. O₂ consumption is calculated in (ml/min)/M². (LaFarge and Miettinen, pages 23-30.)

For Males:

$$O_2 \text{ Consumption (ml/min/m}^2) = 138.1 - (11.49 \times \log_e(\text{age in years})) + (0.378 \times (\text{heart rate}))$$

For Females:

$$O_2 \text{ Consumption (ml/min/m}^2) = 138.1 - (17.04 \times \log_e(\text{age in years})) + (0.378 \times (\text{heart rate}))$$

b) Indexing a measured value

If a measured value is available, use the Oxygen consumption Calculator to convert the measurement to an indexed value. The calculator uses the following formula:

$$O_2 \text{ Consumption (ml/min/m}^2) = \frac{O_2 \text{ Consumption (absolute)}}{BSA}$$

Cardiac Output (Qp and Qs)

Cardiac Index Calculation (Yang et al, page 44):

$$Q_p \text{ (liters/min/m}^2) = \frac{O_2 \text{ Consumption (ml/min/m}^2)}{(PV - PA \text{ content}) \times 10}$$

$$Q_s \text{ (liters/min/m}^2) = \frac{O_2 \text{ Consumption (ml/min/m}^2)}{(SA - MV \text{ content}) \times 10}$$

Cardiac Output Calculation (Yang et al, page 45):

$$Q_p \text{ (liters/min)} = Q_p \text{ (liters/min/m}^2) \times BSA$$

$$Q_s \text{ (liters/min)} = Q_s \text{ (liters/min/m}^2) \times BSA$$

Resistance (Rp and Rs)

Wood's Resistance Unit, also called Hybrid Resistance Unit (Yang et al, page 68):

Wood's Unit = mm Hg min. liter⁻¹ or [(mm Hg)/(liter/min.)]

(Pressures in mm Hg; Flow in liter/min./m²; Resistance in Wood's Units.)

$$R_p \text{ (indexed)} = \frac{\text{mean MPA} - \text{PA wedge}}{Q_p}$$

$$R_p \text{ (abs)} = \frac{R_p \text{ (indexed)}}{BSA}$$

$$R_s \text{ (indexed)} = \frac{\text{mean Sys} - \text{mean RA}}{Q_s}$$

$$R_s \text{ (abs)} = \frac{R_s \text{ (indexed)}}{BSA}$$

New Calculations in PedCath

PedCath8 offer several sets of calculations that were not part of the standard PedCath3 configuration. These new features can be found under the Measurements tab in the PedCath edit screen.

| Hemodynamics | | | | User Fields | | Measurements | |
|-------------------------|------|----------|-----|------------------|------|---------------------|--|
| Ventricular Volume (ml) | | | | Ventricular Mass | | | |
| | EDV | ESV | EF% | % Normal | gm | % Normal | |
| Right | 45.0 | 23.0 | 49% | 205% | 20.0 | 83% | |
| Left | 26.9 | 8.9 | 67% | 127% | | | |
| Valve Diameter | | | | PA Diameter | | | |
| | mm | % Normal | | | mm | % Normal | |
| TV | 18.0 | 93% | | Right | 10.3 | 104% | |
| MV | 19.0 | 113% | | Left | 8.8 | 103% | |
| PV | 15.0 | 133% | | | | PA Index: 335 | |
| AV | 13.0 | 130% | | | | PA Area Index: 1.70 | |

Ejection Fraction

$$\text{Ejection Fraction (\%)} = \frac{\text{End Diastolic Volume} - \text{End Systolic Volume}}{\text{End Diastolic Volume}} \times 100$$

PA Index (PAI)

$$PAI = \Pi \times \frac{\left(\frac{RPA}{2}\right)^2 + \left(\frac{LPA}{2}\right)^2}{BSA}$$

PA Area Index (PAAI)

$$PAAI = \Pi \times \frac{\left(\frac{RPA}{2}\right)^2 + \left(\frac{LPA}{2}\right)^2}{(279.89 \times BSA) - 35.46}$$

References:

Thomas P. Graham, Jr., MD, Jay M. Jarmakani, MD, Ramon V. Canent, Jr., MD and Mary N. Morrow, AB; Left Heart Volume Estimation in Infancy and Childhood; Circulation, Volume XLIII, June, 1971

Thomas P. Graham, Jr., MD, Jay M. Jarmakani, MD, Gerald F. Atwood, MD, and Ramon V. Canent, Jr., MD; Right Ventricular Volume Determination in Children; Circulation, Volume XLVII, January, 1973

Scisuke Nakata, MD, Yasuharu Imai, MD, Yoshinori Takanashi, MD, Hiromi Kurosawa, MD, Kitsuhiko Tezuka, MD, Makoto Nakazawa, MD, Masahiko Ando, MD and Atsuyoshi Takao, MD; A new method for the quantitative standardization of cross-sectional areas of the pulmonary arteries in congenital heart disease with pulmonary blood flow; The Journal of Thoracic and Cardiovascular Surgery, Volume 88, Number 4, October 1984

PedCath Logging

PedCath tracks cath views and edits in compliance with the Health Insurance Portability and Accountability Act (HIPAA). When a user opens the PedCath Edit screen, PedCath will log information about the cath that was viewed, the staff member who viewed it and the date and time (either the local or server time can be used based on your settings). If the staff member edits and saves the cath then PedCath will log this as well.

PedCath also logs anything exported from the system such as when any reports are printed, saved, or emailed. This includes the main PedCath report, a report from the data reporting module, the staff listing report, or a patient's billing information.

The export log keeps track of the staff member, export date and time, and export location for each type of export. The following shows the types of export actions logged and additional information saved.

| <i>Export Actions Logged</i> | Additional information logged |
|--|--|
| Printed the PedCath report | Printer location |
| Saved the PedCath report to a file | Export location, file name |
| Emailed the PedCath report | Mail recipients (To: and CC:) |
| Printed data reports results | Query and printer location |
| Saved data reports results to a file | File name and query |
| Emailed data reports results | Mail recipients (To: and CC:) and query |
| Printed a patient's billing information | Printer location |
| Printed a patient's document | Document title, file name, and printer location |
| Printed the staff listing | Printer location |
| Exported a patient's document | Document title and file name |
| Locked a cath report | none |
| Unlocked a cath report | none |
| Viewed a backup cath report | Backup ID |
| Submitted a study | Study name and study ID |
| Unlocked a study | Study name, study ID, and follow-up title if applicable. |
| Printed HIPAA log | Report description printer location |
| Ran batch export | Path, log file, export file type, total number of cases |
| Move a cath report to a different patient record | Patient MRN, name, and id of both patient records. |
| Run the IMPACT submission | Quarter and year of the submission, and whether patient identifying fields were included or not. |

| | |
|---|--|
| Successful Login, Unsuccessful Attempt, and Logout | Host and username |
| Delete cath report | None |
| Delete patient record | Patient name and ID. |
| Added new staff record | Staff ID, username, and display |
| Disabled staff record | Staff ID, username, and display |
| Reactivate staff record | Staff ID, username, and display |
| Edited a staff record's ID fields (display name, login, hospital staff ID, NPI, LDAP ID), password reset, or changed permission level | Staff ID, username, and display, and id fields that changed. |
| PedCath Error | Error number and description |

PedCath logging data may be viewed from within the Administrative console on the “View HIPAA” tab.

The Diagnostic Code Set

The standard PedCath code set – Summary

If you choose, you may include codes in your **PedCath** cath reports to indicate cardiac and non-cardiac diagnosis, ECG findings, cath procedures, cath complications, surgery and pharmaceutical interventions.

The standard version of the program includes a set of codes developed for this purpose by **Scientific Software Solutions** and our medical advisors. We have found these codes to be complete, without burdening the user with excessive detail.

We are aware that no universally accepted set of codes exists for pediatric catheters. Different institutions use different coding systems, and some do not use a coding system at all.

Our goal is to help you to do your work, your way. If you do not enter diagnosis codes, there will be no loss of functionality in **PedCath**. The list of codes simply will not appear in the printed report.

Optional Code Sets

If you wish to use an alternate code set, we can offer optional sets from some of the major pediatric hospitals. Currently, we have hierarchical coding systems available from the following institutions (all rights reserved by the developing institutions):

Hospital for Sick Children – Toronto, Canada

Texas Children's Hospital – Houston, Texas

Boston Children's Hospital – Boston, Massachusetts

Please call Scientific Software Solutions if you need assistance in creating an optional code set for your hospital. We can provide limited technical assistance in testing code set compatibility, and may be available on a contractual basis to customize **PedCath** to your individual needs.

It is important to select a code set before entering patient data.

If you would prefer to use an optional code set, we recommend that you use it from the start. This will avoid any need to convert old patient records at a later date.

IMPACT Registry Code Set

If your institution participates in the IMPACT Registry, the IMPACT code set for procedures, surgeries, diagnosis and events will be available for coding within the IMPACT Registry module. PedCath will also allow you to use those codes for the PedCath report if you choose. This can be easily configured with an administrative setting. When doing so the codes entered for the cath report will automatically transfer to the IMPACT module eliminating the need for cross-coding.

A complete listing of the Diagnostic Codes selected by your hospital follows this page.