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Area	Laboratory-Chemistry
Applicability	All Beaumont Hospitals

Formulas for Manual Calculations

Document Type: Guideline

I. PURPOSE AND OBJECTIVE:

A. The purpose of this procedure is to specify formulas needed to manually calculate results.

II. FORMULAS:

A. Anion Gap = Sodium – (Chloride + Carbon dioxide)

B. Globulin = Total Protein – Albumin

C. A/G Ratio = Albumin / (Total Protein – Albumin)

D. Cholesterol/High Density Lipoprotein Ratio = Chol/HDL

E. Non HDL Cholesterol = Chol – HDL = mg/dL

F. LDL Cholesterol = Total Chol – HDL – (Trig/5)
Note: Formula for calculation only if Trig<400 mg/dL

G. BUN/Creatinine Ratio = BUN/Creatinine

H. CKD-EPI Estimated GFR (mL/min/1.73 m^2) = $142 \times \min(S_{cr}/\kappa, 1)^{\alpha} \times \max(S_{cr}/\kappa, 1)^{-1.200} \times 0.9938^{Age} \times 1.012$ [if female]

1. S_{cr} is serum creatinine in mg/dL
2. κ is 0.7 for females and 0.9 for males
3. α is -0.241 for females and -0.302 for males
4. min indicates the minimum of S_{cr}/κ or 1
5. max indicates the maximum of S_{cr}/κ or 1

a. Example for a female patient: 142 x $\min(S_{Cr}/0.7,1)^{-0.241}$ x $\max(S_{Cr}/0.7,1)^{-1.200}$ x 0.9938^{Age} x 1.012

b. Example for a male patient: 142 x $\min(S_{Cr}/0.9,1)^{-0.302}$x $\max(S_{Cr}/0.9,1)^{-1.200}$ x 0.9938^{Age}

I. CKD-EPI Cystatin C Equation (2012) Estimated GFR (mL/min/1.73 m^2) = 133 × $\min(S_{cys}/0.8, 1)^{-0.499}$ × $\max(S_{cys}/0.8, 1)^{-1.328}$ × 0.9936^{Age} × 0.932 [if female]

1. S_{cys} is standardized serum cystatin C in mg/L
2. min indicates the minimum of S_{cys} /0.8 or 1
3. max indicates the maximum of S_{cys} /0.8 or 1
4. age is years

J. CKD-EPI Cystatin C Equation Estimated GFR Under 25 (mL/min/1.73 m^2) = K x $(1/S_{cys})$

1. S_{cys} is standardized serum cystatin C in mg/L
2. Male 1-15 years K = 87.2 ×$1.011^{(age\ years-15)}$
3. Male 15-18 years K = 87.2 ×$0.960^{(age\ years-15)}$
4. Female 1-12 years K = 79.9 ×$1.004^{(age\ years-12)}$
5. Female 12-18 years K = 79.9 ×$0.974^{(age\ years-12)}$

K. Estimated GFR (mL/min/1.73 m^2) = 133 × $\min(S_{cys}/0.8, 1)^{-0.499}$ × $\max(S_{cys}/0.8, 1)^{-1.328}$ × 0.9936^{Age} × 0.932 [if female]

L. % Saturation = 100 x [serum Iron/ (Transferrin x 1.4)]

M. Total Iron Binding Capacity = Transferrin x 1.4

N. Urine Albumin/Creatinine Ratio = (ualb mg/dL/Urine Creatinine mg/dL) x 1000

O. Urine Creatinine Clearance mL/min

$$\frac{\text{Raw Urine Creatinine mg/dL}}{\text{Serum Creatinine mg/dL}} \times \left(\frac{\text{TV mL}}{\text{Hrs collection}} \times \frac{1\text{ Hr}}{60\text{ min}}\right)$$

P. Urine (Ur) Creatinine Clearance Pediatric mL/min CC Corrected =

$$\frac{\text{Raw Ur Creat mg/dL}}{\text{Serum Creat mg/dL}} \times \left(\frac{\text{TV mL}}{\text{Hrs collection}} \times \frac{1\text{Hr}}{60\text{min}}\right) \times \left(\frac{1.73\ m^2}{\text{surface area } m^2}\right)$$

NOTE: Surface area m^2 is determined from child's height and weight.

Q. Urine Creatinine Timed or 24 Hour mg/Collection (Coll) =

$$\text{Raw Urine Creatinine } \frac{\text{mg}}{\text{dL}} \times \text{dilution} \times \left(\frac{\text{TV mL}}{\text{Coll.}} \times \frac{10\text{dL}}{1000\text{mL}}\right)$$

R. Urine Amylase Timed Ur/Hr =

$$\text{Raw Urine Amylase } \frac{\text{U}}{\text{L}} \times \text{dilution} \times \frac{\text{TV mL}}{\text{Hrs of Coll.}} \times \frac{1\text{L}}{1000\text{mL}}$$

S. Urine Calcium Timed or 24 Hour, mg/Collection =

$$\text{Raw Urine Calcium } \frac{\text{mg}}{\text{dL}} \times \text{dilution} \times \left(\frac{\text{TV mL}}{\text{Coll.}} \times \frac{10\text{dL}}{1000\text{mL}}\right)$$

T. Urine Glucose Timed and 24 Hour, g/Collection =

Raw Urine Glucose mg x dilution x (TV mL x 10dL) x g
dL Coll. 1000mL 1000mg

U. Urine Magnesium Timed or 24 Hour, mg/Collection =
Raw Magnesium mg x dilution x (TV mL x 10dL)
dL Coll. 1000mL

V. Urine Phosphorous Times or 24 Hour, g/Collection =
(Raw Urine Phos mg x 1g) x dilution x (TV mL x 10dL)
dL 1000mg Coll. 1000mL

W. Urine Protein Timed or 24 Hour, mg/Collection =
Raw Urine Protein mg x dilution x (TV mL x 10dL)
dL Coll. 1000mL

X. Urine Urea Nitrogen Timed or 24 Hour, mg/Collection =
Raw Urine Urea Nitrogen mg X dilution X (TV mL X 10dL)
dL Coll. 1000mL

Y. Urine Uric Acid Timed or 24 Hour, mg/Collection =
Raw Urine Uric Acid mg X dilution X (TV mL X 10dL)
dL Coll. 1000mL

Z. Urine Sodium Timed or 24 Hour, mmol/Collection =
Raw Urine Sodium mmol X dilution X (TV mL X 1L)
L Coll. 1000mL

AA. Urine Potassium Timed or 24 Hour, mmol/Collection =
Raw Urine Potassium mmol X dilution X (TV mL X 1L)
L Coll. 1000mL

AB. Urine Chloride Timed or 24 Hour, mmol/Collection =
Raw Urine Chloride mmol X dilution X (TV mL X 1L)
L Coll. 1000mL

AC. Urine Albumin excretion, mcg/min =
Raw Urine Albumin mg X dilution X (TV mL X 10dL) X 1000 mcg X (Collection X 1 hr)
dL Coll. 1000mL 1 mg (number hours X 60 min)

AD. Urine Albumin timed or 24 hour, mg/Collection=
Raw Urine Albumin mg X dilution X (TV mL X 10dL)
dL Coll. 1000mL

AE. % Urine Amylase / Creatinine Clearance Ratio =
Raw Urine Amylase U/L X Serum Creatinine mg/dL X100
Serum Amylase U/L Raw Urine Creatinine mg/dL
NOTE: reference range 1.3-4.3%

AF. Urine Protein / Creatinine Ratio =
Raw Urine Protein mg/dL
Raw Urine Creatinine mg/dL
NOTE: reference range 0.0-0.2

AG. Urine Calcium / Creatinine Ratio =

$$\frac{\text{Raw Urine Calcium mg/dL}}{\text{Raw Urine Creatinine mg/dL}}$$

NOTE: reference range 0.02-0.26

AH. AAPO2, mmHg = ((713mmHg x FiO2 as decimal) – (PCO2 / 0.8)) - PO2

AI. PF, no units = PO2 / FiO2 (as a decimal value)

AJ. % Free PSA = (Free PSA/PSA) X 100

AK. Albumin gradient; Serum and Ascites fluid, g/dL = Albumin (g/dL) – Albumin fluid (g/dL)
NOTE: >1.1 = Transudate
0.2-1.0 = Exudate

Attachments

Formulas for Manual Calculations CalculationVerification Worksheet Attachment A_1_2023.pdf

Approval Signatures

Step Description	Approver	Date
Medical Directors	Muhammad Arshad: Physician	3/1/2023
Medical Directors	Vaishali Pansare: Chief, Pathology	2/10/2023
Medical Directors	Jeremy Powers: Chief, Pathology	2/8/2023
Medical Directors	Ryan Johnson: OUWB Clinical Faculty	2/2/2023
Medical Directors	Ann Marie Blenc: System Med Dir, Hematopath	2/1/2023
Medical Directors	John Pui: Chief, Pathology	2/1/2023
Policy and Forms Steering Committee Approval (if needed)	Colette Kessler: Mgr, Division Laboratory	2/1/2023
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