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# Abbreviations

d: days

m: months

w: weeks

y: years

M: male

F: female

Only ranges pertinent to study patients have been defined

# 1. LABORATORY METHODS AND NORMAL RANGES: PLASMA AND BLOOD

## Laboratories related to site 001

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Biopole 21 Site du Parc de l’Europe Dijon, FRANCE | Potassium (mmol/L) | Age: 3 y | 3.5 - 5.1 | Direct potentiometry |
| Bicarbonate (mmol/L) | Age: 3 y | 22 - 30 | Spectroreflectometry |
| Pôle de Biologie Hospice civils de Lyon (hospital Laboratory).Lyon, FRANCE | Potassium (mmol/L) | Age: 28 d - 2 y2 - 15 y> 15 y | 4.1 - 5.33.4 - 4.73.5 - 4.8 | Indirect potentiometry(Abbott Architect) |
| Bicarbonate (mmol/L) | Age: 28 d - 15 y15 - 60 y> 60 y | 20 - 28 22 - 29 23 - 31  | PEP carboxylase UV |
| Phosphate (mmol/L) | Age :1 - 5 y5 - 13 yM: 13 - 16 yF: 13 - 16 y16 - 19 y> 19 y | 1.39 - 2.21.32 - 1.911.03 - 1.781.13 - 2.00.94 - 1.620.74 - 1.52 | Photometry UV (Abbott Architect) |
| Calcium (mmol/L) | Age:10 d – 2 y2 – 12 y12 – 60 y> 60 y | 2.25 - 2.752.20 - 2.702.10 - 2.552.20 - 2.50 | Photometry Arsenazo III (Abbott Architect) |
| 25-OH vit D (nmol/L)  | 40 - 125 | Chemiluminescenceimmunoassays |

##

## Laboratories related to site 002

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| BioaxomeChemin de Saint PaulManduel, FRANCE | Potassium (mmol/L)  | 3.5 - 5.1 | Potentiometry |
| Bicarbonate (mmol/L) | 22 - 29 | Spectrophotometry |
| Pole Biologie CHU de Nîmes (hospital Laboratory).Nîmes, FRANCE | Potassium (mmol/L)  | Age:1m - 3 y3 -15 yAdults | 4.1 - 5.33.4 - 4.73.5 - 5.1 | Potentiometry |
| Bicarbonate (mmol/L) | Adults | 22 - 29 | PEP carboxylase UV |
| Phosphate (mmol/L) | Age:1 - 3 y3 - 6 y6 - 9 yM : 9 - 12 yF : 9 - 12 yM : 12 - 15 yF : 12– 15 y15 - 18 y> 18 y | 1 - 1.951.05 - 1.81.00 - 1.81.05 - 1.851.05 - 1.70.95 - 1.650.90 - 1.550.85 - 1.60.81 - 1.45 | Spectrophotometry |
| Calcium (mmol/L) | Age:10d - 2y2 - 12y12 - 18y18 - 60y | 2.25 - 2.752.20 - 2.702.1 - 2.552.15 - 2.50 | Spectrophotometry |
| 25-OH vit D (nmol/L)  | 75 - 175 | Immunoluminometry |

##

## Laboratories related to site 003

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Laboratoire de la Trillade (BIOTOP)Avignon, FRANCE | Potassium (mmol/L) | 3.0 - 4.5 | Indirect potentiometry  |
| Bicarbonate (mmol/L) | 20 - 28 | PEP carboxylase UV |
| BioaxomeLaboratoire de la chartreusePlace de la CroixVilleneuve-lès-Avignon, FRANCE | Potassium (mmol/L) | 3.4 – 4.5 | Indirect Potentiometry |
| Bicarbonate (mmol/L) | 20 - 28 | PEP carboxylase UV |
| Laboratoire Rey Port de BoucPort de Bouc, FRANCE | Potassium (mmol/L)  | Age: 2 - 7 y | 3.5 - 5.0 | K Ion selective electrode (Beckman Coulter) |
| Bicarbonate (mmol/L) | Age: 2 - 7 y | 21 - 31 | CO2 ion selective electrode (Beckman Coulter) |
| LaboSud ProvencePort-de-Bouc, FRANCE | Potassium (mmol/L)  | 3.5 - 5.1 | Ion selective electrode indirect |
| Bicarbonate (mmol/L) | 20 - 28 | PEP Carboxylase UV |
| Biologie médicale de l’APHM (hospital Laboratory). Marseille, FRANCE | Potassium (mmol/L) | Age:< 1 yAdults | 3.7 - 5.23.4 - 4.5 | Indirect potentiometry |
| Bicarbonate (mmol/L) | Age:1 - 6 mAdults | 20 - 2922 - 29 | PEP carboxylase UV |
| Phosphate (mmol/L) | Age:30 d - 10 y10 - 15 yAdult | 0.95 - 1.750.95 - 1.650.81 - 1.45 | Phosphomolybdate UV |
| Calcium (mmol/L) | Age :10 d - 2y2 - 12y12 - 18y18 - 60y60 - 90y> 90y | 2.25 - 2.752.20 - 2.702.10 - 2.552.15 - 2.52.20 - 2.552.05 - 2.40 | NM-BAPTA |
| 25-OH-Vit D(nmol/L) | Age:2y - 15y | 75 - 250 | Electrochemiluninescence |

##

## Laboratories related to site 005

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Laboratoire de Biologie médicale Hopital Robert Debré (hospital laboratory).Paris, FRANCE | Potassium (mmol/L)  | Age:1 m - 2 y2 -15 y> 15 y | 3.7 - 5.43.1 - 4.73.5 - 4.5 | Direct potentiometry Siemens (Advia 1800) |
| Bicarbonate (mmol/L) | Age :1m - 2 y2 - 15 y> 15 y | 18 - 2720 - 2822 - 29 | PEP carboxylase UV |
| Phosphate (mmol/L) | Age:1m-2y2-15y>15y | 1.5-2.301.30-1.850.87-1.5 | Phosphomolybdate UV Siemens (Advia) |
| Calcium (mmol/L) | Age :1m-15y>15y | 2.20-2.702.25-2.60 | O-cresolphtaleine complex Roche (Advia 1800) |
| 25-OH vit D(μg/L) | 20 - 60 | Chemiluninescence immunoassaysYSIS |

##

## Laboratories related to sites 007 and 009

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Laboratoire AlesiaParis, FRANCE | Potassium (mmol/L)  | Age: Adults | 3.5 – 5.0 | Potentiometry  |
| Bicarbonate (mmol/L) | Age: Adults | 22 - 29 | Colorimetric (Roche) |
| Laboratoire d’OzoirOzoir La Ferrière, FRANCE | Potassium (mmol/L)  | Age: Adults | 3.5 – 5.1 | Potentiometry  |
| Bicarbonate (mmol/L) | Age: Adults | 22 - 29 | Chemiluminescence Architect (Abbot)  |
| Pole Biologie Médicale Hôpital Necker-enfants maladies (hospital Laboratory).Paris, FRANCE | Potassium (mmol/L)  | Age :1 m - 13 yAdults  | 3.1 - 4.73.5 - 4.5 | Indirect potentiometry |
| Bicarbonate (mmol/L) | Age :1 m - 3 y3 - 15 yAdults | 19 - 2420 - 2822 - 29 | PEP carboxylase UV |
| Phosphate (mmol/L) | Age:3m - 2y2y - 15yadult | 1.50 - 2.301.30 - 1.850.85 - 1.50 | Enzymatic |
| Calcium (mmol/L) | Age :1m - 13yadult | 2.20 - 2.702.25 - 2.60 | Colorimetry |
| 25-OH Vit D(μg/L)  | 30 - 60 | IDS-Isys 25 OHD |

##

## Laboratories related to site 008

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Pôle Biologie du CHU de Bordeaux (hospital Laboratory).Bordeaux, FRANCE | Potassium (mmol/L)  | Age:3m - 7 y> 7 y | 3.5 - 5.33.5 – 5.0 | Indirect potentiometry  |
| Bicarbonate (mmol/L) | 23 - 29 | PEP carboxylase UV |
| Phosphate (mmol/L) | Age:7 d – 2 y2 y - 18y18 y - 130 y | 1.2 - 2.21.0 - 1.80.8 - 1.4 | Spectrophotometry |
| Calcium (mmol/L) | > 10 d | 2.2 - 2.65 | Colorimetry |
| 25-OH vit D(ng/mL)  | 30 - 100 | Chemiluminescence |

##

## Laboratories related to site 012

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Laboratoire du marchéAudincourt, FRANCE | Potassium (mmol/L)  | Age: > 18 y | 3.5 - 5.5 | Indirect Potentiometry |
| Bicarbonate (mmol/L) | Age: > 18 y | 20 - 31  | PEP Carboxylase UV |
| Laboratoire de Terre RougeBesançon, FRANCE | Potassium (mmol/L)  | Age: > 18 y | 3.5 – 5.1 | Indirect potentiometry |
| Bicarbonate (mmol/L) | Age: > 18 y | 21 - 32  | Enzymatic  |
| Laboratoire de Biologie Médicale CHRU de Besançon (hospital Laboratory)Besançon, FRANCE | Potassium (mmol/L)  | 3.5 - 5.1 | Indirect potentiometry |
| Bicarbonate (mmol/L) | 21 - 32 | PEP carboxylase UV |
| Phosphate (mmol/L) | 0.96 - 1.59 | Spectrophotometry |
| Calcium (mmol/L) | 2.12 - 2.52 | Colorimetry Arsenazo III |
| 25-OH vit D (ng/mL)  | 30 - 100 | Chemiluminescence immunoassays YSIS |

##

## Laboratories related to site 013

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Centre de Biologie CHRU de Lille(hospital Laboratory).Lille, FRANCE | Potassium (mmol/L)  | Age:1 - 18 y> 18 y | 3.1 - 5.13.5 - 5.0 | Ion selective electrode Indirect potentiometry |
| Bicarbonate (mmol/L)  | Age:1 - 18 y> 18 y | 20 - 3122 - 29 | PEP carboxylase UV(total CO2) |
| Phosphate (mg/L) | 34 - 55 | Molybdate UV |
| Calcium (mg/L) | > 1 y | 85 - 105 | NM BAPTA colorimetry |
| 25-OH vit D (μg/L) | 30 - 60 | Chemiluminescence immunoassays |

##

## Laboratories related to site 015

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Laboratoire BiolianceSaint Herblain, FRANCE | Potassium (mmol/L)  | Age: 8 y | 3.7 - 5.2 | Indirect potentiometry |
| Bicarbonate (mmol/L) | Age: 8 y | 22 - 29 | PEP carboxylase UV |
| Laboratoire de biochimie généraleHotel Dieu. Centre Hospitalier Universitaire (hospital laboratory). NantesFRANCE | Potassium (mmol/L)  | Age:1 - 24 m2 - 12 y12 - 120 y | 3.7 - 5.43.1 - 4.73.4 - 4.5 | Potentiometry |
| Bicarbonate (mmol/L) | Age:1 - 2 y2 - 12 y12 - 120 y | 20 - 2721 - 3124 - 34 | PEP carboxylase UV |
| Calcium (mmol/L) | Age:1 - 3 y3 - 13 y13 - 18 y18 - 60 y60 - 90 y90 - 120 y | 2.25 - 2.752.20 - 2.702.10 - 2.552.15 - 2.502.20 - 2.552.05 - 2.40 | Colorimetry |
| 25-OH vit D (ng/mL) | 30 - 60 | Chemiluminescence immunoassays |

##

## Laboratories related to sites 202 and 301

|  |  |  |  |
| --- | --- | --- | --- |
| **Laboratory name/address** | **Parameters (units)** | **Normal ranges**  | **Analysis method** |
| Clinical Center of Nis(hospital Laboratory)Niš, SERBIA | Potassium (mmol/L)  | 3.1 - 5.8 | Indirect potentiometry |
| Bicarbonate (mmol/L)  | 18 - 25 | Indirect method with blood gas |
| Phosphate (mmol/L) | 0.9 - 1.95 | Modified phosphomolybdate (PHOS) with PMAPS and bisulfite |
| Calcium (mmol/L) | 2.1 - 2.75 | Schwarzenbach's with OCPC, adapted for colorimetric determination with quinolones |
| 25-OH-vit D (ng/mL) | 30 - 100 | ECLA-electro-chemiluminescence assay |
| Children’s University Hospital Bratislava (hospital laboratory).Bratislava, SLOVAKIA | Potassium (mmol/L)  | 3.5 - 5.5 | Ion selective electrodes, indirect method (Roche) |
| Bicarbonate (mmol/L) | 22 - 26 | Calculated using Hendersen-Hasselbalch equation: Derived parameter from RapidLab 1265 (Siemens) |
| Phosphate (µg/L) | Age:>3m -16y>16y F>16y M | 20 - 20015 - 15030 - 400 | Photometric method with ammonium molybdate (Roche) |
| Calcium (mmol/L) | 2.25 - 2.85 | Photometric method (Roche) |
| 25-OH-vit D (µg/mL) | 30 - 99 | Competitive Immunoassay, Vitros Immunochemical Method, Ortho Clinical Diagnostics |

## Central laboratory

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Laboratoire de biochimie et de biologie moléculaire des Hospices Civils de Lyon, FRANCE | Bone alkaline phosphatase (µg/L) | Age0 - 2 y3 - 4 y5 - 6 y7 - 8 y9 - 10 y11 - 12 y13 - 14 y15 - 16 y17 y≥18 y | F 41.9 - 10729.5 - 108.521.9 - 115.437.1 - 147.942.0 - 107.638.6 - 111.213.7 - 109.810.2 - 72.65.9 - 20.04.9 - 26.6 | M43.4 - 104.829.7 - 84.848.8 - 109.052.6 - 123.052.3 - 105.455.7 - 152.315.5 - 134.016.6 - 127.911.0 - 77.65.5 - 22.9 | ImmunoluminometryCLIA Liaison XL(Diasorin) |
| Parathyroid hormone (ng/L) | 5.5 – 38.5 | ImmunoluminometryCLIA Liaison XL(Diasorin) |
| 1,25-diOH vit D(pmol/L) | 69 - 200 | ImmunoluminometryCLIA Liaison XL(Diasorin) |

# 2. NORMAL RANGES: URINE RATIOS AND RISK OF LITHOGENESIS

|  |  |
| --- | --- |
| **Urine parameters (units)** | **Normal values**  |
| *Urine ratios* |
| Calcium/creatinine(mol/mol) [1-2] | 5 to 11 m1 to < 2 y 2 to < 3 y 3 to < 5 y 5 to < 7 y 7 to < 10 y 10 to < 14 y14 to 17 yAdults | ≤ 2.2≤ 1.5≤ 1.4≤ 1.1≤ 0.8≤ 0.7≤ 0.7≤ 0.7≤ 0.5 |
| Citrate/creatinine (mmol/mmol) [3] | M 2 to <7 y M 7 to <13 y M 13 to <18 yM AdultsF 2 to <7 yF 7 to <13 yF 13 to <18 yF Adults | ≥ 0.142≥ 0.082≥ 0.052≥ 0.052\*≥ 0.171≥ 0.154≥ 0.127≥ 0.127\* |
| *Risk of lithogenesis* |
| Calcium/citrate (mmol/mmol)[4]  | All | ≤ 3 |

\* The reference limit for adolescents also applied to adults according to expert opinion

1. Matos V, van Melle G, Boulat O et al (1997) Urinary phosphate/creatinine, calcium/creatinine, and magnesium/creatinine ratios in a healthy pediatric population. J Pediatr 131:252-257.

2. Frey J, Daudon M, Raby N et al (2001) Valeur sémiologique des paramètres biochimiques urinaires. Ann Biol Clin 59:13-25.

3. Kirejczyk JK, Porowski T, Konstantynowicz J et al (2014) Urinary citrate excretion in healthy children depends on age and gender. Pediatr Nephrol 29:1575-1582.

4. Parent X BG, Brignon P (1999) Lithiase oxalocalcique. Relation entre facteurs de risque biochimiques et phase cristalline du calcul. Prog Urol 6:1051-1056.