## TITLE: Collection, Determination and Calculation of Urine Specimens

## PRINCIPLE: To provide a guide to collecting, determining and calculating urine specimens. Most urine testing is performed as a way of diagnosing and monitoring kidney disease, though other disease states can also be diagnosed by urine testing. Two disease states may include diabetes and toxemia in pregnancy. For testing principles, refer to the individual testing procedures.

## SPECIMEN COLLECTION/TREATMENT:

1. Properly collected 24 hour urine, 12 hour urine, 2 hour urine, or random/spot urine:
2. A 24 hour urine collection is the preferred specimen for all urine testing. The 24 hour urine eliminates the variance of the urine concentration at different times during a day. Normal values are also established from 24 hour urine testing.
3. 12 hour urine specimens are acceptable for creatinine clearance testing.
4. 2 hour urine specimens are acceptable for timed urine amylase testing.
5. Random “spot” urines are accepted for all urine testing, however, they are not the specimen of choice. Urine osmolality, sodium and glucose are the only tests which have established normal values. All other random urine testing does not have established normal values.
6. The proper collection technique for a timed urine:
7. The patient is to void and discard the urine specimen. This will be considered the “collection start time”. This will ensure that the patient has an empty bladder at the start of collection.
8. All of the remaining urine voided during the collection time is to be placed in the proper urine collection bottle. The patient must be careful not to lose or discard any of the urine.
9. At the time the collection is to end, the patient is to void again, completely emptying the bladder and placing the specimen into the proper collection bottle.
10. Once the collection is complete, the urine specimen should be brought to the Laboratory as soon as possible.
11. Proper preservatives must be added for some urine testing. (Refer to the table in the “Procedure” section for individual urine testing and the preservatives that are required to perform those tests).
12. Once the urine is in the Laboratory, mix, measure and record the volume on the computer label. If the volume is in question, call the floor or the doctor’s office to verify if a complete collection was obtained.
13. Pour off urine into a 100ml sterile cup and label with the computer LIS patient information label. Be certain to include the total volume of the collection on the label. Aliquot the urine into a 13 x 100 glass tube (put a barcode label on the tube).
14. Adjust the pH of the urine if it is necessary. (Refer to the table to determine if this is required).
15. Centrifuge all specimens.
16. If a creatinine or urea nitrogen clearance has been ordered, a serum or heparinized plasma specimen is required to perform the serum creatinine and/or BUN.
17. The specimen should be collected during the urine collection time.
18. If the specimen was not collected during the 24 hour period, it must be collected within 24 hours of urine collection.

## REAGENTS AND EQUIPMENT:

Refer to individual test procedures for reagent preparation.

Vitros 1- Primary

Back-up – Vitros 2

###### Advanced Micro-Osmometer and supplies

0.9% Saline

Preservatives: 6N HCL

Brown Collection Bottles

Transfer Pipettes

**CALIBRATION:**

Consult manual and follow procedure for specific test and instrument used.

**QUALITY CONTROL:**

1. Bio-Rad Urine Control Level 1 and 2 are to be run whenever patient testing is ordered. The test that is to be run should be specific for the testing that has been ordered.
2. Follow routine quality control procedures and policies for test and instrument used. Refer to the “Current Quality Control Material and Schedule” procedure in the General Chemistry Procedure Manual..

## STEPWISE PROCEDURE:

1. Run the urine chemistries, except Osmolality, on the Vitros 5600 .
2. If the Vitros 5600 does not read the barcode and a manual data entry is required, the technologist/technician must change the specimen type to URINE. This will automatically signal the instrument to dilute the specimen. If the result is out of linear range after automatic dilution, do a manual dilution using the recommended dilution material. The result must then be calculated and recorded on the printout.

For known transplant patients, initial dilutions should be x 10. To ensure accuracy, subsequent dilutions (as high as 200) may be necessary. It may be easier to make a x10, x100 and x200 dilution and run all dilutions at one time.

1. Calculations will automatically be calculated through the Laboratory Information System. If the system is down and the calculations cannot be done automatically, refer to the “Calculations” section of this procedure to perform the calculations manually.
2. Calculate “timed” urine specimen values according to the example in the “calculation” section.
3. If the result obtained is less than the lower limit of the assay, result the test as less than the lower limit of the assay range..

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| --- | --- | --- | --- | --- | --- |
| **TEST** | | **MATERIAL USED FOR DILUTION** | **PRESERVATIVE USED FOR URINE** | **INTERFERRING PRESERVATIVES** | **ASSAY**  **RANGE** |
| Amylase | | Isotonic Saline\* | None Refrigerated | EDTA – Citrate-Oxalate | 30-1200 U/L |
| Urea Nitrogen | | Reagent Grade Water\*\* | None Refrigerated | None | 67-2520  mg/dL |
| Calcium | | Reagent Grade Water or Isotonic Saline | 6N HCL to pH less than 2 | EDTA – Citrate | 1-17.8  mg/dL |
| Creatinine | | Reagent Grade Water | None Refrigerated | All Preservatives | 1.2-346.5 mg/dL |
| Glucose | | Reagent Grade Water or Isotonic Saline | None Refrigerated | None | 20-650 mg/dL |
| Phosphorous | | Reagent Grade Water | 10-20 6M-HCl per 24 hour collection | None | 5.5-143.0 mg/dL |
| Uric Acid | | Reagent Grade Water | None Refrigerate | None | 5.5-  187.0  mg/dL |
| Na+  K+ | | Reagent Grade Water | None Refrigerate | None | 5.0-250.0 mmol/L  2.5-175.0 mmol/L |
| Chloride | | Do Not Dilute | None Refrigerate | All Preservatives | 15-300 mmol/L |
| Osmolality | | None | None | All Preservatives | 0-2000 mOsm/ |
| Magnesium | | Reagent Grade Water | 20 mL 6MHCl  per 24 hour collection, pH <1.0 | All Preservatives | 1.2-60.0 mg/dL |
| Protein | Reagent Grade Water | | None Refrigerate | All Preservatives | 5-200  mg/dL |

### \* Isotonic Saline or FS Diluent Pack 2

\*\* Reagent Grade Water or FS Diluent Pack 3

### CALCULATIONS

1. Multiply the instrument printout by the dilution factor (if any) before proceeding with further calculations.

EXAMPLE: Creatinine printout result = 13.4 mg/dL

Dilution used = 1:10

Final result = 13.4 mg/dL x 10 = 134 mg/dL

2. Use the following formulas to calculate timed collections. Show all calculations on the appropriate worksheet.

1. When the test results are units per liter:
2. Formula:

Results x 24 hour volume = units/24 hours

1000

1. Where:
2. result = units/liter x dilution (if any)
3. 24 hour volume = ml
4. To correct for ml per 1 liter = 1 liter

1000 ml

1. EXAMPLE: Sodium result = 90 mmol/L (no dilution required)

24 hour total volume = 1500 mL

Final Result = 90 mmol/L x 1500 ml = 135 mmol/24 hours

1000

1. When the test results are units per deciliter:
2. Formula:

Test results x 24 hour volume = units/24 hour

100

2. Where:

1. Test results = units/dL x dilution (if any)
2. 24 hour volume = mL
3. Correction for dL = 1 dL

1. EXAMPLE: Uric Acid Result Printout = 9.5 mg/dL

Dilution used = 1.5

24 hour volume = 900 mL

Final Result = (9.5 mg/dL x 5) x 900 mL = 428 mg/24 hrs.

100

1. For BUN, the results are reported as gm/24 hours. The formula is as follows:

Test results x 24 hour volume = g/24 hours

100,000

1. Where:
2. Test result = units x dilution
3. 24 hour volume =mL
4. correction for dL = 1 dL

mL 100 mL

1. correction for g = 1 g

mg 1000mg

1. EXAMPLE: BUN result printout – 50.6 mg/dL

Dilution used = 1:10

24 hour urine volume = 1200 mL

Final Result = (50.6 mg/dL x 100) x 1200 mL = 6 gm/24 hr

100,000

1. Clearance Calculations: Creatinine

(Urine Result X Total Volume (mL) x 1.73)/Minutes of collection

Serum result x BSA

Where:

1. BSA = Body Surface Area Calculated using the Mosteller Formula or as calculated by LIS.
2. Total volume = mL of urine in total collection
3. Minutes of collection = 24 hour = 1440 minutes or (hours x 60)
4. 1.73 is the standard body surface area

NOTE: If the patient’s height and weight are not known, leave the 1.73 factor and the BSA factor in #1 out of the equation.

1. Urine Result = mg/dL x dilution (if any)
2. Serum Result = mg/dL result of the patient’s serum creatinine. The serum creatinine specimen is to be drawn any time during the urine collection time.
3. EXAMPLE:

Urine Creatinine result printout = 12.5 mg/dL

Urine Dilution used = 1:10

Serum Creatinine = 1.5 mg/dL

24 hour urine total volume = 1300 mL

24 hour collection = 1440 minutes

BSA = 1.60

1300 mL

(12.5 mg/dL x 10) x 1300 mL x 1.73/1440 = 81 mL/minutes

1.5 mg/dL x 1.60

1. BSA – Body Surface Area for Clearance

**Mosteller Formula**





1. Osmolality is reported as mOsm/kg. The result from the osmometer is the result that is reported in the Laboratory Information System. No calculation is required.

### REPORTING RESULTS

1. Laboratory Information System Entry:

Enter the results of the urine tests under “Accession Result Entry” for the Vitros 5600 instruments. The LIS will automatically do calculations for you.

1. Electrolytes are reported out as mmol/24 hours.
2. Random urine electrolytes are reported as mmol/L.
3. Most chemistries are reported as mg/24 hours.
4. Urea nitrogen is reported as g/24 hours.
5. Random urine glucose is reported as mg/dL.
6. Osmolality is reported as mOsm/kg.
7. Creatinine clearance is reported as mL/minute.
8. 2 hour or 24 hour amylase is reported as IU/2 hours or IU/24 hours.
9. Urea Nitrogen Clearance is reported as mL/minute.

Timed urine reference ranges are as follows:

24 hour Amylase 59-401 U/24 hours

Random Amylase 32-641 U/L

Urea Nitrogen 12-20 g/24 hours

Calcium 100-300 mg/24 hours

Creatinine 1000-2000 mg/24 hours male

800-1800mg/24 hours – female

Creatinine Clearance 80-180 mL/min

Glucose 0- 500 mg/24 hour

Random Glucose 0-30 mg/dL

Phosphorus 400-1300 mg/24 hour

24 hour Protein 42-225 mg/24 hour

Random Urine Protein 0-12 mg/dL

Uric Acid 250-750 mg/24 hour

Sodium 40- 220 mmol/24 hour

Potassium 25 – 125 mmol/ 24 hours

Chloride Random 18-209 mmol/ L

Chloride 0 – 12 years 15 – 40 mmol/24 hours

Adult (over 12 years) 110-250

mmol/24 hour

Standard Clearance 42 – 65 mL/min

Osmolality (spot or 24 hour) 300-1300 mOsm/kg

Magnesium 73-122 mg/24 hour

1. If the Creatinine Clearance collection is not 24 hours, report normals as follows:

NORMAL = 80 – 180 ml/min

Normal range is based on 24 hour urine collections.

1. Spot urines are reported as the result (x) dilution factor (if any). We do not have normal values for most random/spot urine tests. The only exceptions are osmolality, protein, amylase glucose and chloride. With any other random results, the following statement must be included: “No known reference ranges established.”

NOTES: Urine collection bottles for the floors are ordered through S.P.D.

**REFERENCES:**

1. Clinical Diagnosis and Management by Laboratory Methods, John Bernard Henry, M.D., 2001.

2. Vitros 5600 Instructions for Use.