Bismuth

Atomic number 83
Atomic weight 208.98

Collection

Blood	2 mL	Plastic tube Anticoagulant: EDTA
Urine	20 mL	Sterile Universal

Send empty container together with any sample type if uncertain about possible contamination

Reference ranges

			Reference
Serum/plasma	m/L	Less than 3.3	1
Blood	nmol/L	Less than 5 nmol/L	1-3
Urine	nmol/L	Less than 0.2 nmol/L	4
	nmol/24 h	<0.72	5
	nmol/mmol creatinine	<0.1	5,6

Notes

	Blood
Acceptable during therapy	Up to 250 nmol/L
Therapeutic warning level	250-500 nmol/L
Risk of toxicity	Greater than 500 nmol/L

References

1. Slikkerveer A. Bismuth: Biokinetics, Toxicity and experimental therapy of overdosage. 1992, PhD Thesis University of Leiden
2. Slikkerveer A and de Wolff FA. Pharmacokinetics and toxicity of bismuth compounds. *Med Toxicol Adv Drug Exp* 1989; **4**: 303-323.
3. Heitland P, Köster HD. Biomonitoring of 37 trace elements in blood samples from inhabitants of northern Germany bu ICP-MS. J Trace Elem Med Biol 2006; 20(4): 253-62.
4. Hoet P, Jacquerye C, Deumer G, Lison D, Haufroid V. Reference values and upper reference limits for 26 trace elements in the urine of adults living in Belgium, Clin Chem Lab Med, 2013; 51: 839-849.
5. Sieniawska CE, Jung LC, Olufadi R, Walker V, Twenty-four hour urinary trace element excretion: reference intervals and interpretive issues. Ann Clin Biochem 2012; 49: 341-51.
6. Morton J, Leese E, Tan E, Cocker J. Determination of 61 elements in urine samples collected from a non-occupationally exposed UK adult population, Toxicol. Letters 2014; 231: 179-193.

Clinical

Sources:

Bismuth occurs in its native form and in minerals such as bismite (bismite oxide) usually associated with sulphide ores of lead and copper. Most bismuth is incorporated into low-melting alloys. The remainder is used for catalysts, pigments in cosmetics, pharmaceuticals (e.g. treatment of peptic ulcer disease) and industrial chemicals.

Biology:

Bismuth compounds are moderately absorbed through the respiratory and gastrointestinal tracts and there is some absorption through the skin although no quantitative data is available.

Ingested bismuth is largely eliminated unabsorbed in faeces. Absorbed bismuth is mainly excreted in the urine.

The biological half-life of bismuth is variable depending on the tissue compartment, but is approximately 6 days.

Toxicity:

The toxicity of bismuth can be overlooked. It can cause acute renal failure secondary to tubular necrosis – glomeruli are relatively unaffected. A neurological syndrome exists characterised by confusion, tremor, clumsiness, myoclonic jerks and gait disturbance (median bismuth concentration reported approximately 3000 nmol/l). Occasionally dermatological manifestations occur with rosea-like eruptions and stomatitis.

Although the placenta is permeable to bismuth no teratogenicity has been reported.

Laboratory indices:

Urine is the matrix of choice for suspected bismuth toxicity (because of rapid renal clearance) although blood can be measured in the presence of renal failure.

References:

1. Slikkerveen A and de Wolff FA. Pharmacokinetics and toxicity of bismuth compounds. *Med Toxicol Adv Drug Exp* 1989; **4**: 303-323.
2. Hillemand P. *et. al*. Bismuth treatment and blood bismuth levels. *Sem Hop* 1977; **53**: 1663-1669.