Arsenic

Atomic number 33
Atomic weight 74.92

Collection

Blood	10 mL	Plastic container Anticoagulant: EDTA Send unseparated blood
Urine	20 mL	Sterile Universal

Reference ranges

			Reference
Serum/plasma	nmol/L	20-100	1
Blood	nmol/L	14-95	1
Urine	nmol/L	160-213	2
	µmol/24 h	< 6.1	3
	nmol/mmol creatinine	<12.9	2

As species – Urine[4]	nmol/L		nmol/mmol creatinine	
	median	95th ile	median	95th ile
As^{III}	0.11	0.54	0.19	0.99
As^{V}	--	3.1	--	0.35
MMA	7.5	31.6	0.90	3.08
DMA	32.5	169	4.30	16.08
arsenobetaine	51.6	1690	10	174.7

Notes

Diets rich in seafoodgive misleading results (several thousand nmol/L have been reported) due to presence of non-toxic organo-arsenic compounds. Exclude from diet for five days prior to sampling.

Other foodstuffs such as chicken, rice and rice products also contain arsenicals and may influence results.

References

1. Cesbron A, Saussereau E, Mahieu L, Couland I, Guerbet M, Goulle. J-P Metallic profile of whole blood and plasma in a series of 106 healthy volunteers. J. Anal Tox 2013; 37: 401-405.
2. 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
3. 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. [Not controlled for consumption of seafoods]
4. Leese E, Morton J, Tan E, Gardiner HE, Carolan VA. µLC–ICP-MS determinations of unexposed UK urinary arsenic speciation reference values. J. Anal Tox 2014; 38: 24-30.

Clinical

Arsenic is an ubiquitous element, and although it is apparently essential for certain animal species, its significance in man lies in the acute and chronic toxicity that results from overexposure. Fish and crustaceans contain particularly high amounts of non-toxic forms of organic arsenic in their tissues, and in the human body the element is concentrated largely in hair and nails. The element is present in the ores used in the smelting of copper, lead and zinc, and the resulting production of arsenic trioxide is a potential health hazard. In both inorganic and organic forms the element is widely used as an insecticide, herbicide, feed additive and wood preservative. More recently, the semiconductor industry has become a major user of arsenic compounds.

Toxicity

Although there are substantial differences in the toxicities of different arsenic compounds, acute exposure usually causes abdominal pain, weakness, trembling, increased salivation, jaundice, diarrhoea and vomiting. Long term exposure to smaller amounts causes similar symptoms in a milder form which, of course, resemble those of many chronic diseases. This similarity has made the element popular for many centuries as a deliberate poison. Concern regarding the exposure of industrial workers to arsenic compounds has increased following the realisation that arsenic may be carcinogenic.

Traditional Asian remedies may contain substantial amounts of arsenic, and cases of toxicity from their use have been reported both from India and the UK.

Recent descriptions of situations with whole populations suffering from arsenic toxicity in areas of Bangladesh and China are associated with drinking water with high natural levels of arsenic, made available by new wells

The element probably exerts its toxic effects by its ability to bind to sulphydryl groups in tissue proteins, although cellular metabolism may also be disrupted by arsenate analogues of phosphate compounds. The well known antidote to arsenic poisoning, British Anti Lewisite (BAL; Dimercaprol) is effective by virtue by its ability to bind arsenic through its sulphydryl groups.

Laboratory Indices of Exposure

Arsenic is excreted in the urine and measurement of the urinary arsenic output is the determination of choice. Concentrations both in blood and urine will increase after the consumption of sea food. Separation of the arsenic species in urine is necessary to distinguish between the toxic and non-toxic forms. Alternatively known sources of non-toxic arsenic should be excluded from the diet some five days before making an assessment.