Clinica Chimica Acta 471 (2017) 6–11

Contents lists available at ScienceDirect

Clinica Chimica Acta

journal homepage: www.elsevier.com/locate/cca

Review

Recognizing and differentiating uncommon body fluids: Considerations and tools for a proper practical approach

Pim M.W. Janssens

Laboratory of Clinical Chemistry and Haematology, Rijnstate Hospital, P.O. Box 9555, 6800 TA Arnhem, The Netherlands

ARTICLE INFO

Keywords:
Uncommon body fluid
Effusion
Markers
Exudate
Pleural fluid
Ascites

ABSTRACT

Clinical laboratories are regularly requested to inspect uncommon body fluids obtained from patients because clinicians are uncertain as to the origin of the collected material. They may need this information for the actual diagnosis, to confirm a supposition, or for guiding treatment and invasive operations like draining and puncturing. Often there is also a need to know more precisely what is going on in the cavity that gave rise to the fluid, for instance a local infection or metastasis, or whether the cavity is connected to organs or fluid compartments nearby etcetera. The results of the laboratory investigations often have () direct consequences. As the investigation of uncommon body fluids is distinct from routine laboratory analyses it requires special attention. This paper presents an overview of the characteristics of uncommon human body fluids, constituents useful as markers for recognizing and differentiating fluids and considerations that have to be taken into account when interpreting the results of analyses. In addition a number of practical recommendations for approaching the task of identifying uncommon body fluids are given.

1. Introduction

Most analyses in clinical laboratories, by far, are performed in blood and urine. With some frequency, however, also body fluids of less common origin are presented, to answer questions like: from what place in the body does the sample exactly originate, does the fluid possibly contain a significant amount of fluid originating from another body cavity, and what are (some of) the constituents of the sample? [1–3]. A common example is the investigation of fluid obtained by puncturing, or coming from a drain for which the doctor wants to check whether the fluid indeed originates from the presumed body cavity. Another regularly encountered example is the inspection of a body fluid originating from a part of the body where surgery took place, aiming to determine whether the place of incision is well sutured and the wound properly closed. Sometimes, as third example, the investigation of uncommon body fluid is specially undertaken to guide a specific diagnosis as suggested by the mere presence or absence of specific analytes, for instance tumour markers. Reasons for the investigation of uncommon body fluids range from clinical necessity to mere curiosity about what produced the sample and is going on in it. This knowledge can be crucial for diagnosis and knowing what is going on in the patient's body, or just be helpful in supporting assumptions related to diagnosis and treatment based so far on clinical observations or imaging techniques. Not infrequently the results of the laboratory investigations have direct consequences for treatment [3]. It is my personal view that laboratories are meant to investigate; laboratory employees and staff (scientists) may be expected to be capable of solving biochemical-clinical puzzles. So I think that laboratories should actively be involved in solving the puzzles presented in relation to the uncommon body fluids presented to the laboratory.

Body fluids, well known but less frequently analyzed in clinical laboratories than blood and urine, are cerebrospinal fluid (CSF), sperm, faeces, sweat, synovial fluid, saliva, pleural fluid, ascites and amniotic fluid. These and other even less common fluids are collectively denoted here as 'uncommon body fluids'. Making an overview of these, more than 30 uncommon body fluids can be distinguished (Table 1). For most of these there is rarely, if ever, a request for investigation. This can be explained by the limited availability of these fluids, resulting from the fact that they are difficult to collect in living humans (e.g. endolymph, pancreas fluid, ovarial cyst fluid), or from the fact that there are hardly if ever clinically relevant questions related to these fluids (e.g. cervical mucus, sebum, meconium, colostrum, tears).

The body fluids presented to the laboratory for identification are in our experience mostly obtained by puncturing cavities (pleural cavity, abdominal cavity, cysts, synovium), fluids dripping from drains, moisture (dripping or wetness) appearing on the skin as a result of tissue damage and unusual samples from the urogenital area or tract and intestines (obtained from the rectum or otherwise) [1–3]. In general, the doctor requesting the investigations can provide information as to the location in or on the body that gave rise to the sample.

E-mail address: pjanssens@rijnstate.nl.

http://dx.doi.org/10.1016/j.cca.2017.05.005
Received 16 January 2017; Received in revised form 5 May 2017; Accepted 6 May 2017
Available online 07 May 2017

Table 1
Overview of characteristic markers for the identification of various body fluids. In particular markers for which assays are widely available in clinical laboratories are mentioned. The most specific markers for various body fluid have been underlined. Additionally, the characteristic sodium, potassium and protein concentrations are indicated as these are often useful to distinguish different fluids.

Body fluid	Constituent	Interpretation, comment
Amniotic fluid	α-Fetoprotein	8–20 mg/l; > 500 × the serum value for pregnant and non-pregnant women [28,29]
	Sodium	134.6 ± 1.9 mmol/l [33]; varies (slightly) in relation to the duration of the pregnancy [28]
	Potassium	4.6 ± 0.1 mmol/l [33]; varies (slightly) in relation to the duration of the pregnancy [28]
	Protein	3.8–8.5 g/l; early and in the midst of pregnancy, 1.5–3.5 g/l end of pregnancy [1,28]
	Fern test	Positive test distinguishes amniotic fluid from urine and predicts delivery [34]
Ascites	Protein	9–17 g/l [21,22] For discriminating transudate and exudate in ascites, the serum–ascites albumin gradient (SAAG) is considered the best test. A gradient < 11 g/l suggests exudate [2,21,22]. For other discriminating tests, see Transudate.
	Bilirubin (additional marker)	> 100 μmol/l or a concentration > 17 μmol/l higher than serum suggests presence of bile [2]
	Creatinine and urea (additional markers)	Concentrations significantly higher than in d to blood values signifies erroneous sampling (from the bladder) or bladder rupture [2]
	Cholesterol (additional marker)	> 1.24 mmol/l often accompanies malignancy leading tot ascites [2]
	LDH (additional marker)	Ratio ascites: serum > 0.6 often accompanies malignancy leading tot ascites [2]
	pH (additional marker)	< 7.3 suggests exudate resulting from infection [2]
	Alkaline phosphatase	Values higher than in blood values suggest disorders impairing intestinal integrity [2]
	Tumour markers (additional marker)	Marker type dependent on type of malignancy; not recommended for screening or diagnosis [2,5,14]
	Cells (additional marker)	Cell count or cytology; kind of cells determined by the type of disease (infection or malignancy) [2]
Bile	Bilirubin	1–2 mmol/l (> 1000 × serum values) [27]
	Sodium	141–165 mmol/l [27]
	Potassium	2.7–6.7 mmol/l [27]
	Protein	< 10 g/l [27]
Breast milk (milk > 3 days following delivery)	Fat	Week 1: 25.9 g/l, week 2–8: 34.6 g/l (range 32.5–36.9 g/l) [35]
	Protein	Week 1: 19 g/l, week 2–8: 12.7 g/l (range 10.2–15.8 g/l) [35]
	Lactose	Week 1: 165–190 mmol/l, week 2–8: 180 mmol/l [35]
	Sodium	About 5 mmol/l [36]
Broncho-alveolar lavage (BAL) fluid	Protein	0.6 g/l [37]
Cerebrospinal fluid	β2-Transferrine (tau, asialo-transferrine)	Unique for CSF in non-pathological conditions [2]; in case of chronic alcohol abuse also present in blood (CSF) and some types of congenital disorders of glycosylation [38,39]
	Transthyretin (former name prealbumin)	Present in CSF [1], but also in tears, breast milk, amniotic fluid [1]
	Sodium	136–150 mmol/l (i.e. comparable to serum values) [9,28]
	Potassium	About 2.8 mmol/l (about 70% as compared to serum) [9,28]
	Chloride	About 119 mmol/l (about 15% higher than in serum, as compensation for low amniotic protein concentration) [9,28]
	Protein	150–600 mg/l (approximately 100 times lower than serum value) [2]
	Albumin	100–300 mg/l (approximately 100 times lower than serum value) [1]
	Cells (lymphocytes, erythrocytes)	Leukocytes: neonates 0–0.030 × 10^9/l, adults 0–0.005 × 10^9/l; erythrocytes not present [2]
Cervical mucous	Tough and elastic gel	[40]
Cervico-vaginal fluid	Fetal fibronectin (fFN)	> 50 μg/l predicts preterm delivery [41,42]
Chyle	Triglycerides, chylomicrons	> 1.24 mmol/l [14]
Cochlear fluid (endolymph)	Sodium	1 mmol/l [43]
	Potassium	About 150 mmol/l [43]
Colostrum (breast milk day 1–3 after delivery)	Fat	22 ± 9 g/l [44]
	Protein	27 ± 15 g/l [44]
	Lactose	> 115 mmol/l [44]
Earwax	Mixture of sebum, hair, keratin, furfur	A wet and a dry type exist [45]
Faeces	Sodium	32 mmol/l (4.4–112) [46]
	Potassium	75 mmol/l (29–147) [46]
Fetal blood	Fetal erythrocytes	> 99% [30,31]
	Fetal hemoglobin (HbF)	50–85% [30,31]
	α-Fetoprotein	> 50 mg/l (at term); during pregnancy higher values (up to 5 g/l) [29]
Gastric fluid (gastric juice)	pH	1–3 [47]
	Sodium	30–40 mmol/l [48]
	Potassium	24–29 mmol/l [48]
	Chloride	72–96 mmol/l [48]
Interstitial fluid	Sodium	134.6–135.7 mmol/l [49]
	Potassium	3.17–3.97 mmol/l [49]
	Protein	20.6 g/l [49]
	Albumin	12.5 g/l [49]
		Interstitial fluid can be considered lymph that has not merged into lymph vessels; both fluids have very similar composition

(continued on next page)