



CURRENT TRENDS IN THE PRACTICE OF LABORATORY MEDICINE

Emilia P. Georgieva¹, Galina R. Petrova², Todorka I. Kostadinova², Stanislava Pavlova³

1) Training and research sector "Medical laboratory assistant", Medical College of Varna

2) Department of Economics and Management of Health, Medical University - Varna

3) Department of Health care, Medical University - Varna, Bulgaria.

SUMMARY:

The paper presents the perspectives and the possible benefits of the POCT tests, conducted outside of the clinical laboratories. Laboratory tests are objective in their character, which is one of the main reasons for the constant increase in the number of laboratory tests.

The fast development of the technology in clinical laboratories, leads to the constant introduction of new markers, as well as the methods and equipment for the establishment of their values. Moving the laboratory diagnostics closer to the patient's location (point of care testing) is a new tendency in the policy of health care. The tendency may be applied and is expanding, because of the fast development of biotechnologies. In a worldwide scale, POCT is essential for the public health care.

Key words: laboratory diagnostic, laboratory service, point of care test,

INTRODUCTION

Clinical laboratory results are an integral part of the diagnostic process and the diagnosis and treatment control, depend on them. One of the main problems for the clinical laboratory is the constant increase of the conducted tests. According to WHO data, it has doubled in the last five years. To solve these problems, essential changes are occurring in the organization and activity of the clinical laboratories, by strengthening the centralization of the tests, the productivity and the accuracy of the results, increased. The development of laboratory technology, informatics and computers, gave the opportunity for automation of the pre-analytical and analytical processes.

The implementation of innovative technologies in laboratory medicine significantly increased the diagnostic potential. The placement of an accurate diagnosis and monitoring of the illnesses requires a correct interpretation of clinical laboratory markers during the laboratory diagnostics. In parallel with the process of centralization of the laboratory tests, a dynamic in the laboratory tests near the patient's bed (POCT), is also observed. The development of the POCT technology and moving the laboratory tests closer to the patient is a significant accomplishment for modern technologies in medicine [1, 2].

MATERIAL AND METHODS:

Retrospective analysis, covering 20 publications in the 2001-2011 periods, regarding the benefits from the application of the POCT tests in laboratory practice.

DISCUSSION:

In the recent years, the technologies are increasing the possibility to conduct laboratory tests close to the patient's location – point of care testing (POCT) [3, 4, 5]. The essential accomplishment is the change in location for the laboratory tests, which are conducted outside of a specialized medical laboratory. The term for that kind of analysis is "near patient testing" - tests, next to the patient's bed [6]. POCT is defined as a laboratory test, conducted in the general practitioner's office, the patient's home or in any place, that is outside of the specialized laboratory. The POCT analysis, gives an opportunity for: quick diagnostics, especially in the pediatric pathology and with elderly people; large economic effect from the timely service and treatment of the patient, without having to hospitalize him (complications are avoided); reduction in the antibiotic therapy, that is expensive for the health insurance; shortening TAT (therapeutic turn-around time) – the time to start the treatment; reduction in the patient's visitations from physicians [7].

Presently, laboratory data impacts more than 70% of medical decisions, and with an annual growth in volume of more than 10%, POCT is one of the fastest-growing areas of clinical lab testing. The expansion of evidence-based medicine in pre-hospital care, community para-medicine and critical care transport, the proper use of well-defined pre-hospital POCT has the potential to improve patient care and reduce overall healthcare costs.

The POCT tests may be grouped by important specifics: related to emergency medical indications for sending the patient to a hospital – troponin T, troponin I, BNP, glucose, myoglobin, D-dimer; related to specific, periodically tested laboratory parameters in chronic and prolonged illnesses, for therapy control – glucose, urea, creatinine, prothrombin time (PT / INR, Alere, Microvisk Ltd), hemoglobin; related to the patient's comfort during screening and diagnostic tests – urine analysis, cholesterol, glucose, triglycerides, HDL cholesterol, PSA, CRP, Streptococcus A, hepatitis B, hepatitis C, AIDS and other; in the hospital units and sectors, outside of the laboratory – ROTEG, acid-alkaline profile, glucose; POCT

systems, grouped on the basis of different chemical principles: spectrophotometry, immune chromatography, biosensors. They are also grouped, based on their analytical reliability: range of detectability, accuracy, range of measurement of the method, cut off values [8, 9, 10]. The tests of that kind, allow to be conducted outside of the specialized medical laboratory.

The main aim of the POCT test is an improvement of patient care, by the fast provision of reliable laboratory re-

sults. The POCT analyzers are intended for decentralized testing and offer comfort for the patient and a more timely information for the physician, for making the clinical decisions on location [11, 12, 13].

They offer fast and safe service and more effective monitoring of healing of patient and also guarantee safety of the personnel of staff in making the tests [14, 15]. The portfolio of POCT increasing continuously and up to date over 110 tests shown on Fig. 1. [16] are available.

Fig. 1. POCT test menu 2013. [16]

CLIA – Waived only	CALCIUM (IONIZED)	GLUCOSE	MYOGLOBIN	SPECIFIC GRAVITY	NTproBN
ACT	CALCIUM (TOTAL)	HBA 1 C	NITRITE	ANTIDEPRESSANTS	O2 CONTENT
APTT	THC	Pregnancy	NGAL	TRIGLYCERIDES	O2 SAT
ALB	TOTAL CO2	HDL	OPIATES	TROPONIN 1	OXYHb
ALP	CL	HCO3	PH	BUN	PF
AMPHETAMINES	CHOLESTEROL	Hct	PCP	URIC ACID	Total HgB
ACETAMINOPHEN	COCAINE	HgB	PHOS	UROBILINOGEN	TotalO2
AMYLASE	CK	KETONE	PCO2	VLDL	Carboxy HgB
ANION GAP	CKMB	LACTATE	PO2	WBC	EEG
AST	CREA	LDH	K	WBC DIFF	PLATELET COUNT
BNP	eGFR	LDL	PROPOXYPHENE	BASE EXCESS	
BARBITURATES	CRP	LEUCOCYTE	PROTEIN	TCHDL RATIO	
BANZODIAZEPINES	cTnI	Mg	PT/INR	Non HDL CHOLESTEROL	
TCO2	D-dimer	METHADONE	Na	HEMATURIA	
BILIRUBIN	GGT	METHAMPHETAMINE	sO2	METHEMOGLOBIN	

In the USA POCT analysts acute care hospitals. last 5 years POCT test grew in England. With entering of these technologies in England the stress of GPs was reduced. In Germany using of this type tests is 54 % of european market of POCT [10].

In many countries where electronic health insurance is functional main benefits from POCT are relating with getting of promptly results. Thereby they can be shared immediately with all members of multidisciplinary team by special software, which cause improving of communication and coordination through reducing of turn around time (TAT). Fast and objective monitoring of condition of the patient and appoint of therapy are performed. Putting into practice of POCT and electronic medical record lead to reducing the morbidity and the mortality through well direct therapy [2, 12]. Through using of POCT healthy beneficially and economic positive results are note [4]. Researchs from clinic-laboratory analysis can be used as resultant criterion for quality of medical care. The key benefits of point-of-care testing include:

- Positive patient identification;
- Immediate diagnostic test results (reduced test and therapeutic turnaround time);
- Reduction and/or elimination of specimen/sample transport;
- Elimination of blood collection tubes and centrifugation with fresh whole blood specimen;
- Reduced blood specimen volume;
- Room temperature storage of test devices (few require refrigeration);
- Data management and connectivity. Connected

POCT system benefits include:

- Reduction in transcription errors;
- Immediate data analysis-utilization, QC,

compliance, data mining;

- Development of disease specific algorithms- for example, tight glycemetic control.

· New and novel approaches to patient care-for example, patient-centric care.

Bring in use new laboratory technologies, gives an opportunity the tests to be performed at home of patients and they to be part of treatment process. Putting into practice of POCT tests is main factor for developing and achieves control of chronic diseases [13]. Thereby good self-control of disease is achieved, patient complacency and quality of life are improving [7, 11].

Up to date in Bulgaria POCT tests, which are with wide use in hospital and outpatient care are express methods in urinalysis, glucometer and special markers for myocardial injury. POCT analyzers for urine are compact and automatically reading eliminating a number of subjective and objective factors for visual reporting errors, varying degrees of illumination it the room, individual skills of laboratory assistant, incorrect time detection, mistakes in printing of the result. They are proven screening samples, which are invaded in routine urinalysis in the specialized laboratories. Express band test are in use also in multipurpose laboratories, next to the bed of the patient and at homeliness as a means for self-control of the patient [4].

Other group of POCT test used in medical cardiology center, angiography divisions and medical diagnostic laboratories are specific markers for myocardial injury. Clinical laboratory kit with high diagnostic sensitivity as tropine T, tropine I, SK-MB, myoglobin, NT rpo, BNP were approved [6].

Today POCT analyzers for taking measurement of cardiac markers- SK-MB, cTnT, Ntpro, BNP, myoglobin offers to physicians the opportunity to perform complex

quantitative and qualitative analysis to the patient's bedside [4]. One of the first and still most popular analyzer in the country is glucometer. It is used widely for the management of therapy in diabetic patients and strict glycemetic control [6].

Although benefits the seriousness of prehospital POCT cannot be overstated, as use of laboratory results requires not only the actual result but proper training to understand it is significance in the context of the patient's condition. Prehospital systems considering adding point-of-care technology need to consider how the results can impact their patient care.

CONCLUSION:

The main directions in research in the clinical labo-

ratory are aimed at early diagnosis and prognosis of the development of the disease process and prevention of socially important diseases.

The introduction of POCT in laboratory medicine greatly increases the opportunities for diagnostic and change the treatment of various diseases.

Rapid diagnosis, early treatment, saving costs and manpower, the ease of operation, convenient manipulation and testing whole blood without the need for calibration are all advantages that require the use of POCT in the country. Proper and thorough interpretation of the results by the physician during the visit of the patient depends on well-trained personnel conducting the analysis in general medical practice.

REFERENCES:

1. Tzvetkova T, Danev S. Analytical principles and procedures in clinical laboratory. *VAP 2001, Plovdiv*. 69-88. [in Bulgarian]
2. Shishenkov M, Tomova-Dimitrova N, Genev S, Georgieva A, Katsarska I. Determination of glucose in capillary blood samples on abt glucometer 3000. *General Medicine* 2007; 2:76-78. [in Bulgarian]
3. Gilbert HC, Szokol JW. Point of care technologies. *Int Anesthesiol Clinics* 2004 Spring; 42(2):73-94. [PubMed] [CrossRef]
4. Kashlova S, Boncheva M, Madjova V. Review of modern poct tests and systems *General Medicine* 201; 1. [in Bulgarian]
5. Larsson A, Greig-Pylypczuk R, Huisman A. The state of point-of-care testing: a european perspective. *Upsala Journal of Medical Sciences*. 2015 Mar;120(1):1-10. [PubMed] [CrossRef]
6. Bontcheva M., Survey and analysis of the needs of clinical laboratory tests in general practice, [Dissertation] 2006. [in Bulgarian]
7. Mader FH, Vaysgerber H. General medicine and practice. *Sharov, Sofia*.2002. [in Bulgarian]
8. Tontcheva D. Medical Genetics in post-genome era. *Genomic medicine. Sofia*. 2010. [in Bulgarian]
9. Keffer JH. Economic considerations of point-of-care testing. *Am J Clin Pathol*. 1995 Oct;104(4 Suppl 1):S107-10. [PubMed]
10. Kost GJ, Sakaguchi A, Curtis C, Tran NK, Katip P, Louie RF. Enhancing crisis standards of care using innovative point-of-care testing. *Am J Disaster Med*. 2011 Nov-Dec;6(6):351-368. [PubMed]
11. Tran NK, Kost GJ. Worldwide point-of-care testing: compendiums of POCT for mobile, emergency, critical, and primary care and of infectious diseases tests. *The Journal of Near-Patient Testing&Technology*. 2006 Jun;5(2): 84-92.
12. Egerer K, Feist E, Burmester GR. The serological diagnosis of rheumatoid arthritis: antibodies to citrullinated antigens. *Dtsch Arztebl Int*. 2009 Mar;106(10):159-163. [PubMed] [CrossRef]
13. Kost GJ, Katip P, Corbin CM. Strategic Point-of-Care Requirements of Hospitals and Public Health for Preparedness in Regions At Risk. *Point Care*. 2012 June 1;11(2):114-118. [PubMed].
14. Howick J, Cals JW, CaJones J, Price CP, Plüddemann A, Heneghan C, et al. Current and Future Use of Point-of-Care Tests in Primary Care: An International Survey in Australia, Belgium, The Netherlands, the UK and the USA. *BMJ Open*. 2014; 4:e005611. [CrossRef]
15. Nosanchuk JS, Keefner R. Cost analysis of point-of-care laboratory testing in a community hospital. *Am J Clin Pathol* 1995 Feb;103(2):240-243. [PubMed]
16. Point of Care Search. Available <http://www.pointofcaresearch.com>

Please cite this article as: Georgieva EP, Petrova GR, Kostadinova TI, Pavlova S. Current trends in the practice of laboratory medicine. *J of IMAB*. 2015 Jul-Sep;21(3):840-842. DOI: <http://dx.doi.org/10.5272/jimab.2015213.840>

Received: 21/05/2015; Published online: 05/08/2015

Address for correspondence:

Emilia Georgieva,
Training and research sector Medical laboratory assistant, Medical College of
Medical University, Varna
84, Tsar Osvoboditel Str., Varna, Bulgaria.
Tel.: +359 52 677 261
E-mail: Emiliya.Georgieva@mu-varna.bg