https://doi.org/10.46389/rjd-2022-1167
www.rjdnmd.org

Rom J Diabetes Nutr Metab Dis
2022; volume 29, issue 3, pages 306-309

Original Article

Optimization of diagnosis in patients with diabetes mellitus and other comorbid pathology in emergency abdominal surgery

Fedir Vasyliovych Grynchuk [1]*, Andrii Ihorovych Shurma [1], Michael Ivanovich Sheremet [1], Andriy Fedorovych Grynchuk [1], Volodymyr Volodymyrovych Tarabanchuk [1], Oksana Yuriyivna Olinik [2], Oleksandr Volodymyrovych Lazaruk [3], Yan Viktorovych Gyrla [1], Oleksandr Vyacheslavovych Bilookyi [1]

[1] Department of Surgery No.1, Bukovinian State Medical University, Chernivtsi, Ukraine
[2] Department of Internal Medicine and Infectious Diseases, Bukovinian State Medical University, Chernivtsi, Ukraine
[3] Department of Pathology, Bukovinian State Medical University, Chernivtsi, Ukraine

* Correspondence to: Fedir Vasyliovych Grynchuk, Department of Surgery No.1, Bukovynian State Medical University, Chernivtsi, Ukraine. E-mail: fedir.grynchuk@bsmu.edu.ua

Received: 22 April 2022 / Accepted: 20 June 2022

Abstract

Our study assessed the possibility of using ODVP determination in PC patients for diagnostic purposes. The study was carried out on 18 healthy donors and 107 patients (51 with CP). Venous blood was collected through a puncture of the ulnar vein and ODVP was measured on an Agilent Cary 100/300 Series UV-Vis spectrophotometer. Donors at the wavelength λ=310 nm found the maximum values of ODVP, which reaches 1.9 units. There were no gender differences. ODVP increased and was different, especially with respect to the type of disease. ODVP in patients with AH, AAC, ACC, AEP and CP was higher than in patients without CP. ODVP in patients with AA, SH, AIO and CP were lower than in patients without CP, but it was not significantly lower. ODVP in patients with ANP and CP was lower than in patients without CP, but was still higher ($p<0.05$) than in donors. In the plasma of healthy donors at a wavelength λ=310 nm, there is a maximum value of ODVP, which reaches 1.9 units, while in patients with acute surgical diseases of the abdominal cavity at this wavelength, ODVP is statistically significantly higher than in donors. ODVP in the presence of CP is also statistically significantly greater than in donors. ODVP in the presence of DM is slightly smaller than in other CP but larger than in donors. Preliminary results indicate that the determination of ODVP at wavelength λ=310 can be used for diagnosis in emergency abdominal surgery.

Keywords: comorbid pathology, diabetes mellitus, optical density, venous blood plasma, emergency abdominal surgery.

Abbreviations: AA – acute appendicitis; AAC – abdominal abscess; ACC – acute calculous cholecystitis; AEP – acute edematous pancreatitis; AIO – acute intestinal obstruction; ANP – acute necrotic pancreatitis; CP – comorbid pathology; DM – diabetes mellitus; LA – liver abscess; ODVP – optical density of the venous plasma; SH – strangulated hernias.

Introduction

One of the problems of emergency abdominal surgery is the diagnosis of acute surgical diseases of the abdominal cavity in patients with comorbid pathology [1–7]. First of all, this applies to patients with diabetes mellitus (DM), which has long been considered a significant risk factor [8–14]. The clinical symptoms of these patients change, making diagnosis difficult. The main laboratory tests are leukocytes and C-reactive protein [1–7], but in patients with comorbid pathologies, particularly with DM, these indicators are unreliable, which is a consequence of comorbidities. [10–14]. In cases of complex diagnosis, additional methods are used, such as CT and laparoscopy. [15–19]. However, such methods cannot always be used immediately, and

laparoscopy is an invasive method. Therefore, searching for new diagnostic methods for comorbid pathology is an urgent issue. For this purpose, we evaluated the possibility of using the determination of optical density (OD) of venous blood plasma for diagnosing acute surgical diseases of the abdominal cavity in DM and other types of comorbid pathology.

Material and methods

Study design

The study comprised 18 healthy donors, including 10 men and 8 women and 107 patients. Among them, there were 7 patients with liver abscess, 11 patients with abdominal abscess, 16 patients with acute appendicitis, 18 patients with acute calculous cholecystitis, 11 patients with acute necrotic pancreatitis, 16 patients with acute oedematous pancreatitis, 15 patients with strangulated hernias and 13 patients with acute bowel obstruction. A number of 51 patients had concomitant diseases: 20 patients with DM, 14 patients with coronary heart disease, 8 patients with hypertension, 5 patients with chronic hepatitis, 2 patients with chronic pyelonephritis, 4 patients with acute pneumonia, 2 patients with liver cirrhosis, 3 patients with chronic bronchitis, and 5 patients with varicose veins. Among all patients, 12 were suffering from 2 concomitant diseases.

All patients with liver abscesses, abdominal abscesses, acute appendicitis, acute calculous cholecystitis, acute necrotic pancreatitis, strangulated hernias and acute intestinal obstruction have undergone surgery.

Laboratory, anthropometric and clinical data collection

Patients underwent all recommended anthropometric, clinical, laboratory and instrumental examinations. In addition, patients took venous blood by puncture of the ulnar vein to study OD on admission to the hospital.

The venous blood plasma was measured with a Cary Agilent 100/300 series UV-Vis spectrophotometer.

Statistical analysis

The statistical calculations of the research results have been conducted with the help of Microsoft® Office Excel spreadsheets (build 11.5612.5703). The Shapiro – Wilk criterion has checked the law of sample distribution for normality. The student criterion has been used to test the hypothesis of average equality. To check normally distributed samples, the Fisher criterion has been used. The Wilcoxon and Wilcoxon–Mann–Whitney criterion have been applied for samples whose distribution was different from normal.

Results

Healthy donors at a wavelength λ=310 nm (Figure 1) revealed a maximum blood plasma OD value, reaching 1.9 units. There were no gender differences.

In the examined patients, the indicators of venous blood plasma at a wavelength λ=310 nm differed depending on the type of surgical disease (Table 1).

Discussion

The obtained data indicated that the OD of venous blood plasma at a wavelength λ=310 nm in patients with acute surgical diseases of the abdominal cavity without comorbid pathology is statistically significantly higher than in healthy donors. This is a confirmation of our previous information about the possibilities of determining venous blood plasma OD for diagnosis

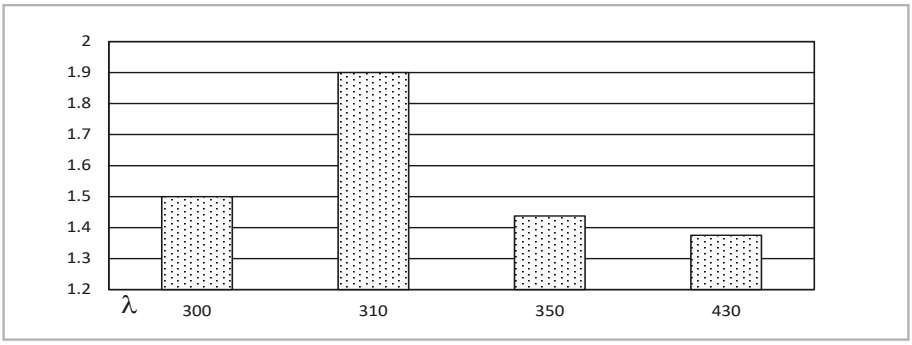

Figure 1: Indicators of optical density of donor blood plasma.

Table 1: Indicators of venous blood plasma at the wavelength=310 nm in the examined patients.

Diagnosis	Without comorbid pathology	With comorbid pathology
Liver abscess	2.26±0.37 (n=4)	2.53±1.01 (n=3)
Abdominal abscess	3.11±1.15 (n=5)	4.5±1.65 (n=3) 4.12±1.95* (n=3)
Acute appendicitis	3.11±1.01 (n=9)	2.42±0.49 (n=3) 2.31±0.34* (n=4)
Acute calculous cholecystitis	2.59±1.62 (n=11)	2.66±1.08 (n=4) 2.59±1.62* (n=3)
Acute necrotic pancreatitis	3.25±1.97 (n=7)	2.14±0.08 (n=4)
Acute edematous pancreatitis	2.13±0.47 (n=8)	3.22±0.44 (n=5) 3.05±0.24* (n=3)
Strangulated hernias	4.14±1.52 (n=7)	3.42±1.33 (n=4) 3.23±0.25* (n=4)
Acute intestinal obstruction	4.16±1.33 (n=5)	3.38±1.32 (n=5) 3.24±1.41* (n=3)

in emergency abdominal surgery [20]. This indicates that such indicators may be a diagnostic criterion for the presence of acute surgical diseases in the abdominal cavity.

The OD of venous blood plasma in patients with liver abscesses, abdominal abscesses, acute calculous cholecystitis, acute edematous pancreatitis and comorbid pathology was even slightly higher than in patients without comorbid pathology. Exhaust rates in patients with acute appendicitis, strangulated hernias, acute intestinal obstruction and comorbid pathology were slightly lower than in patients without comorbid pathology but did not differ statistically significantly. OD in patients with acute necrotic pancreatitis and comorbid pathology was statistically significantly lower ($p<0.01$) than in patients without comorbid pathology, but was still statistically significantly higher ($p<0.05$) than in donors. This indicates that the presence of comorbid pathology in patients with acute surgical diseases of the abdominal cavity does not significantly affect the OD of venous blood plasma. Therefore, the use of such an indicator can be useful for the diagnosis of such diseases.

OD in patients with DM was slightly lower than in patients with other comorbid pathology. However, these indicators were statistically significantly higher than the OD of donors. This indicates the possibility of using such an indicator in diagnosing acute surgical pathology in DM.

It is possible that determining the optical density at a wavelength λ=310 nm can be used to distinguish between different diseases, which is sometimes a difficult problem in emergency abdominal surgery [21–27]. Nevertheless, more research is needed to understand this. Also, note the simplicity and accessibility of the method, as the measurement takes a few minutes.

It should be pointed out that the small number of observations and differences in comorbid pathology does not allow us to draw definitive conclusions about the diagnostic value of the OD of venous blood plasma in emergency abdominal surgery. However, preliminary results indicate the viability of this examination method and the need for further research.

Conclusions

In the plasma of healthy donors at a wavelength λ=310 nm, there is a maximal value of the optical density of the blood plasma, which reaches 1.9 units. Indicators of optical density of venous blood plasma in patients with acute surgical diseases of the abdominal cavity at a wavelength λ=310 nm are statistically significantly higher than in donors. The optical density of venous blood plasma at a wavelength λ=310 nm in patients with comorbid pathology is also statistically significantly higher than in donors. The optical density of venous blood plasma in patients with diabetes is slightly lower than in other comorbid pathologies but higher than in donors. The preliminary results indicate that the determination of the optical density nm optical density of venous blood plasma at a wavelength λ=310 can be used for diagnosis in emergency abdominal surgery.

https://doi.org/10.46389/rjd-2022-1167

Compliance with ethics requirements

The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study.

Conflict of interest

The authors declare no conflict of interest.

References

1. Di Saverio, S., Podda, M., De Simone, B., Ceresoli, M., Augustin, G., Gori, A. *et al.* (2020). Diagnosis and treatment of acute appendicitis: WSES Jerusalem guidelines. World J Emerg Surg. 257(3):449-451.
2. Pisano, M., Allievi, N., Gurusamy, K., Borzellino, G., Cimbanassi, S., Boerna, D. *et al.* (2020). Diagnosis and treatment of acute calculus cholecystitis: World Society of Emergency Surgery guidelines. World J Emerg Surg. 54(1):325-333.
3. Leppäniemi, A., Tolonen, M., Tarasconi, A., Segovia-Lohse, H., Gamberini, E., Kirkpatrick, A.W. *et al.* (2019). The management of severe acute pancreatitis: World Society of Emergency Surgery guidelines. World S Emerg Surg. 356(7)145-161.
4. Birindelli, A., Sartelli, M., Di Saverio, S., Coccolini, F., Ansaloni, L., Ramshorst, G. *et al.* (2017). Repair of complicated abdominal wall hernias: WSES guidelines. World S Emerg Surg. 377 (12):237-240.
5. Sanchit, M., Sharma, D., Vineet, D., Ahuja, M., Paul, J. Thuluvath, M. *et al.* (2021). Liver Abscess: Complications and Treatment: Clinical liver disease guidelines. Clin Liv Deas. 181(3):352-359
6. Richard, P., Krielen, P., Di Saverio, S., Coccolini, F., Biffl, W., Ansaloni, L. *et al.* (2017). Diagnosis and management of adhesive small bowel obstruction (ASBO): Evidence-based guidelines from the world society of emergency surgery ASBO working group. World J Emerg Surg. 290(14): 201-212
7. Hecker, A., Reichert, M, Reuß, C. J., Schmoch, T., Riedel, J.G., Schneck, E. *et al.* (2019). Intra-abdominal sepsis: New definitions and current clinical standards. Langenbecks Arch Surg. 404(3):257-271.
8. Daniel, F.J., McKittrick, L.S., Root, H.F. (1925). Abdominal surgery in diabetes. JAMA. 85(11):809-812.
9. Gusberg, R., Moley, J. (1983). Diabetes and abdominal surgery: the mutual risks. Yale J Biol Med. 56(4): 285-291.
10. Doran, H., Patrascu, T., Pacescu, E., Marin, I., Radu, C. (2001). Acute abdomen and diabetic patients - difficulties of diagnosis and therapeutical decision. Chirurgia (Bucur) 8(1):81-84.
11. Mehrzad, M., Jehle, C., Roussel, L., Mehrzad, R. (2018). Gangrenous cholecystitis: A silent but potential fatal disease in patients with diabetic neuropathy. A case report. World J Clin Cases. 6(15):1007-1011.
12. León-Ballesteros, G., Pérez-Soto, R., Zúñiga-Posselt, K., Velázquez-Fernández, D. (2018). Presentación clínica de la apendicitis aguda en pacientes inmunocomprometidos por diabetes o VIH/sida. Gac Med Mex. 154(4):473-479.
13. Tolstrup, M.B., Watt, S.K., Gögenur I. (2017). Morbidity and mortality rates after emergency abdominal surgery: an analysis of 4346 patients scheduled for emergency laparotomy or laparoscopy. Langenbecks Arch Surg. 402(4):615-623.
14. Macaluso, C.R., McNamara, M. R. (2012). Evaluation and management of acute abdominal pain in the emergency department. Int J Gen Med. 5(3): 789-797.
15. Nielsen, L.B.J., Tengberg, L.T., Bay-Nielsen, M. (2017). Laparoscopy in major abdominal emergency surgery seems to be a safe procedure. Dan Med J. 64(5):A5370.
16. Ietto, G., Amico, F., Pettinato, G., Iori, V., Carcano, G. (2021). Laparoscopy in Emergency: Why Not? Advantages of Laparoscopy in Major Emergency: A Review. Life (Basel). 11(9):917.
17. Hucl, T. (2013). Acute GI obstruction. Best Pract Res Clin Gastroenterol. 27(5):691-707.
18. Millet, I., Sebbane, M., Molinari, N., Pages-Bouic, E., Curros-Doyon, F., Riou, B., *et al.* (2017). Systematic unenhanced CT for acute abdominal symptoms in the elderly patients improves both emergency department diagnosis and prompt clinical management. Eur Radiol. 27(2):868-877.
19. Gavrielli, S., Yan, C., Rogalla, P., Anconina, R., Metser, U. (2021). Ultra-low dose CT abdomen and pelvis for the detection of acute abdominal pathology in the emergency room: initial experience from an academic hospital. Emerg Radiol. 28(1):15-21.
20. Shurma, A.I., Grynchuk, F.V., Motric, A.V. (2021). Preliminary Evaluation of Possibilities for Determination of Optical Density of Venous Blood Plasma for Diagnosis in Emergency Abdominal Surgery. Acta Sci Gastroin Disord. 4(10):49-52.
21. Taylor, M.R., Lalani, N. (2013). Adult small bowel obstruction. Acad Emerg Med. 20(6):528-44.
22. Launay-Savary, M.V., Rainfray, M., Dubuisson, V. (2015). Emergency gastrointestinal surgery in the elderly. J Visc Surg. 152(6):73-79.
23. Mahajan, P., Basu, T., Pai, Ch-W., Singh, H., Petersen, N., Bellolio, F., *et al.* (2020). Factors Associated With Potentially Missed Diagnosis of Appendicitis in the Emergency Department. JAMA Netw Open. 3(3):e200612.
24. Saaristo, L., Ukkonen, M.T., Laukkarinen, J.M., Pauniaho, S-L.K. (2020). The rate of short-term revisits after diagnosis of non-specific abdominal pain is similar for surgeons and emergency physicians - results from a single tertiary hospital emergency department. Scand J Trauma Resusc Emerg Med. 28:63.
25. Eskelinen, M., Meklin, J., Selander, T., Syrjänen, K., Eskelinen, M. (2021). A Diagnostic Score (DS) in the Difficult Diagnosis of Non-specific Abdominal Pain (NSAP). *In vivo*. 35(5):2729-2738.
26. Lebowa, W., Skorus, U., Rapacz, K., Kenig, J. (2021). Indications for Emergency Abdominal Surgeries in Older Patients: 7-Year Experience of a Single Centre. Indian J Surg. 83:78-84.
27. Kassahun, W.T., Babel, J., Mehdorn, M. (2022). Assessing differences in surgical outcomes following emergency abdominal exploration for complications of elective surgery and high-risk primary emergencies. Sci Rep. 25;12(1):1349.