

Wiadomości Lekarskie Medical Advances



VOLUME LXXVI, ISSUE 8, AUGUST 2023

Official journal of Polish Medical Association has been published since 1928

ISSN 0043-5147
E-ISSN 2719-342X



INDEXED IN PUBMED/MEDLINE, SCOPUS, EMBASE, EBSCO, INDEX COPERNICUS,
POLISH MINISTRY OF EDUCATION AND SCIENCE, POLISH MEDICAL BIBLIOGRAPHY

Wiadomości Lekarskie Medical Advances



VOLUME LXXVI, ISSUE 8, AUGUST 2023

Official journal of Polish Medical Association has been published since 1928

ISSN 0043-5147
E-ISSN 2719-342X



Memory of
dr Władysław
Biegański

Wiadomości Lekarskie is abstracted and indexed in: PUBMED/MEDLINE, SCOPUS, EMBASE, INDEX COPERNICUS,
POLISH MINISTRY OF EDUCATION AND SCIENCE, POLISH MEDICAL BIBLIOGRAPHY

Copyright: © ALUNA Publishing.

Articles published on-line and available in open access are published under Creative Commons Attribution-Non Commercial-No Derivatives 4.0 International (CC BY-NC-ND 4.0) allowing to download articles and share them with others as long as they credit the authors and the publisher, but without permission to change them in any way or use them commercially.

The journal Wiadomości Lekarskie is cofinanced under Contract No.RCN/SN/0714/2021/1
by the funds of the Minister of Education and Science



Wiadomości Lekarskie Medical Advances

Editor in-Chief:

Prof. Władysław Pierzchała

Deputy Editor in-Chief:

Prof. Aleksander Sieroń

Statistical Editor:

Dr Lesia Rudenko

Managing Editor:

Agnieszka Rosa – amarosa@wp.pl

International Editorial Office:

Nina Radchenko (editor) – n.radchenko@wydawnictwo-aluna.pl

Polish Medical Association (Polskie Towarzystwo Lekarskie):

Prof. Waldemar Kostewicz – President PTL

Prof. Jerzy Woy-Wojciechowski – Honorary President PTL

International Editorial Board – in-Chief:

Marek Rudnicki Chicago, USA

International Editorial Board – Members:

Kris Bankiewicz	San Francisco, USA	George Krol	New York, USA
Christopher Bara	Hannover, Germany	Krzysztof Łabuzek	Katowice, Poland
Krzysztof Bielecki	Warsaw, Poland	Jerzy Robert Ładny	Białystok, Poland
Zana Bumbuliene	Vilnius, Lithuania	Henryk Majchrzak	Katowice, Poland
Ryszarda Chazan	Warsaw, Poland	Ewa Małecka-Tendera	Katowice, Poland
Stanislav Czudek	Ostrava, Czech Republic	Stella Nowicki	Memphis, USA
Jacek Dubiel	Cracow, Poland	Alfred Patyk	Göttingen, Germany
Zbigniew Gasior	Katowice, Poland	Palmira Petrova	Yakutsk, Russia
Mowafaq Muhammad Ghareeb	Baghdad, Iraq	Krzyszyna Pierzchała	Katowice, Poland
Andrzej Gładysz	Wrocław, Poland	Waldemar Priebe	Houston, USA
Nataliya Gutorova	Kharkiv, Ukraine	Maria Siemionow	Chicago, USA
Marek Hartleb	Katowice, Poland	Vladyslav Smiiianov	Sumy, Ukraine
Roman Jaeschke	Hamilton, Canada	Tomasz Szczepański	Katowice, Poland
Andrzej Jakubowiak	Chicago, USA	Andrzej Witek	Katowice, Poland
Peter Konturek	Saalfeld, Germany	Zbigniew Wszolek	Jacksonville, USA
Jerzy Korewicki	Warsaw, Poland	Vyacheslav Zhdan	Poltava, Ukraine
Jan Kotarski	Lublin, Poland	Jan Zejda	Katowice, Poland

Distribution and Subscriptions:

Bartosz Guterman prenumerata@wydawnictwo-aluna.pl

Graphic design / production:

Grzegorz Sztank fajne.work

Publisher:

ALUNA Publishing
ul. Przesmyckiego 29,
05-510 Konstancin – Jeziorna
www.wydawnictwo-aluna.pl
www.wiadomoscilekarskie.pl
www.wiadlek.pl

CONTENTS

ORIGINAL ARTICLES

- Olha Prykhodko, Olga Avilova, Serhii Dmytruk, Alina Ponyrko, Olena Gordienko, Eleonora Prykhodko
HISTOULTRASTRUCTURAL FEATURES OF THYMOCYTES DUE TO THE IMPACT OF THE EXPERIMENTAL
GENERAL DEHYDRATION OF A MILD DEGREE 1709
- Yuliya Mozgova, Maryna Mishyna, Vasyl Syplyviy, Oleksandr Ievtushenko, Dmytro Ievtushenko, Iryna Marchenko, Yuriy Mishyn
MICROBIOLOGICAL ANALYSIS OF ABDOMINAL CAVITY EXUDATE, BLOOD AND AFFECTED TISSUES SAMPLES
FROM PATIENTS WITH INTRA-ABDOMINAL ABSCESES IN COMPLICATED INFECTION OF ABDOMINAL CAVITY 1717
- Anastasiia Ye. Alatorskykh, Pavlo V. Fedorych, Serhii B. Koval, Taras V. Kuts
TREATMENT OF COMBINED ACNE AND GENITOURINARY INFECTIONS CAUSED BY *CHLAMYDIA* AND *MYCOPLASMAS* 1725
- Yulian Bursuk, Andrii Babko, Serhii Savosko, Ruslan Serhiienko, Olifirenko Oleksii, Viktor Lykhodii, Anna Kondaurava
CHANGES IN ARTICULAR CARTILAGE OF THE HIP JOINT INDUCED BY ACETABULAR LABRUM DAMAGE 1730
- Svitlana Myronchenko, Tetyana Zvyagintseva, Nina Gridina, Nataliia Kytsiuk, Yehor Zhelnin
THE ROLE OF NITRIC OXIDE AND PEROXYNITRITE IN THE ERYTHEMAL PERIOD OF ULTRAVIOLET-INDUCED SKIN DAMAGE 1737
- Hanna Lytvynenko, Olga Lytvynova, Vadym Lytvynov, Mykola Lytynenko, Sergey Latoguz
CHANGES IN THE SERUM LEVEL OF LEPTIN AND TRANSFORMING GROWTH FACTOR-B1 IN PATIENTS WITH ARTERIAL
HYPERTENSION ON A BACKGROUND OF ABDOMINAL OBESITY 1742
- Ihor Deneha, Olha Ripetska, Oleg Mokryk, Volodymyr Hrynovets, Svitlana Ushtan, Yuliia Tykhovska-Izhytska
RELATIONSHIP BETWEEN THE DYSTROPHIC MANIFESTATIONS IN THE PERIODONTIUM AND INTESTINAL DYSBACTERIOSIS 1748
- Kateryna Pikul, Valentina Ilchenko, Liudmyla Syzova, Oksana Muravlova, Iryna Dvornyk
INFECTIOUS MONONUCLEOSIS DURING THE WAR AND COVID INFECTION PANDEMIC IN UKRAINE 1754
- Oleksandra Yu. Kushnir, Iryna M. Yaremii, Kyrylo A. Pantsiuk, Volodymyr V. Vivsyannuk,
Diana M. Tymkul, Kateryna V. Vlasova, Olena V. Vlasova
CARBOHYDRATES METABOLISM IN THE BLOOD OF RATS WITH IMPAIRED GLUCOSE TOLERANCE UNDER
LONG TERM MELATONIN INJECTIONS 1761
- Yuriy Sobolevskiy, Oleksandr A. Burianov, Volodymyr Kvasna, Yevheeny Skobenko, Taras Omelchenko, Vasyl Parii
BIOMECHANICAL STUDY OF MINIMALLY INVASIVE TECHNIQUES IN SURGICAL TREATMENT OF THE TIBIA PROXIMAL
EPIMETAPHYSIS FRACTURES 1768
- Grygoriy P. Griban, Natalia A. Lyakhova, Dmytro G. Oleniev, Oksana P. Kanishcheva, Liana V. Duhina, Tetiana S. Ostrianko,
Ostap S. Skoruy
DYNAMICS OF TOBACCO SMOKING PREVALENCE AMONG STUDENTS AND DIRECTIONS OF ITS PREVENTION 1776

Vasyl I. Rusyn, Fedir M. Pavuk, Vasyl Ya. Fedusyak INFLUENCE OF THE AMOUNT OF COMPRESSION ON VENOUS AND ARTERIAL BLOOD FLOW VELOCITY AND SKIN MICROCIRCULATION OF THE LOWER EXTREMITY	1783
Vasyli B. Makarov, Ninel V. Dedukh, Olga A. Nikolchenko FEATURES OF BONE REMODELING AROUND SURFACE-MODIFIED TITANIUM AND TANTALUM IMPLANTS	1790
Olena V. Kravchenko, Olena A. Tiulienieva, Svitlana M. Yasniovskaya, Alisa V. Goshovska FEATURES OF THE FUNCTIONAL MORPHOLOGY OF THE FULL-TERM PLACENTA IN WOMEN WITH THREATENED ABORTION WITH BLEEDING IN THE FIRST TRIMESTER OF GESTATION	1797
Vasyl Suvorov, Viktor Filipchuk, Michailo Melnyk THE BIOMECHANICAL ANALYSIS OF PELVIC OSTEOTOMIES APPLIED FOR DDH TREATMENT IN PEDIATRIC PATIENTS	1804
Tetiana Vasheka, Oksana Vlasova-Chmeryk, Borys Palamar, Olena Dolgova, Oleksandr Pravda, Sergii Tukaiev, Svitlana Palamar COPING STRATEGIES AND PSYCHOLOGICAL ADJUSTMENT TO THE COVID-19 PANDEMIC AMONG THE UKRAINIAN STUDENTS' YOUTH	1813
REVIEW ARTICLES	
Viktoriiia V. Nadon, Marija V. Mendzhul, Alina V. Hus APPLICATION OF SURROGACY TECHNOLOGY BY FOREIGNERS IN UKRAINE (LEGAL CONFLICT)	1819
Liudmyla A. Vygivska, Natalia V. Derevianchenko, Lesia A. Rudenko, Oleh R. Chebotenko PREECLAMPSIA AND ITS EFFECT ON THE STATE OF CARDIOVASCULAR SYSTEM IN WOMEN	1826
Oleh E. Kanikovskiy, Ihor V. Pavlyk, Yuliia A. Punko, Oleksandr L. Machovskyi, Iryna V. Oliinyk TREATMENT OF PATIENTS WITH CHRONIC PANCREATITIS COMPLICATED BY PANCREATORAGIA	1831
Halyna V. Bilavych, Nataliia M. Blahun, Oktaviia J. Fizeshi, Svitlana J. Dovbenko, Olena M. Shapoval, Nadiya O. Fedchyshyn, Borys P. Savchuk CURRENT PROBLEMS IN COMMUNICATIVE DEVELOPMENT OF CHILDREN WITH SPECIAL EDUCATIONAL NEEDS: UKRAINIAN AND EUROPEAN SCIENTIFIC CONTEXTS	1838
Anatolii V. Vykhreshch, Nadiia A. Danik, Nadiya O. Fedchyshyn, Larysa Ya. Fedoniuk, Tetiana I. Khvalyboha, Solomiia I. Hnatyshyn, Olha M. Khrystenko DIDACTIC CULTURE OF MEDICAL UNIVERSITY TEACHERS AND STUDENTS IN THE CONDITIONS OF WAR	1846

CASE STUDIES

Mykhailo D. Protsailo, Olga Ye. Fedortsiv, Volodymyr G. Dzhyvak, Ihor O. Krycky, Pavlo V. Hoshchynskyi, Ihor M. Horishnyi, Iryna B. Chornomydz, Yana V. Rohalska, Vira O. Synytska, Andrii M. Prodan, Iryna M. Nikitina
CLINICAL FEATURES OF CONNECTIVE TISSUE DYSPLASIA, OSGOOD-SCHLATTER DISEASE AND MULTIPLE CORTICAL DISORDERS IN A CHILD 1854

Yulia A. Tkachenko, Yuriy V. Shkatula, Svitlana N. Kasyan, Yuriy O. Badion
MANAGEMENT OF COMPLICATIONS FOLLOWING BUTTON BATTERY INGESTION 1861

VARIA

Tetiana Danylova, Anatoliy Vovk, Ihor Hoian, Svitlana Kholodynska, Kateryna Honcharenko, Olena Ishchenko, Anna Bezhnar
PHILOSOPHY AND MENTAL HEALTH 1866

Svitlana Storozhuk, Andrii Petraniuk, Nataliia Kryvda, Dmytro Tovmash, Iryna Matviienko, Yevhenii Shushkevych, Ali Hamaidia
TOWARD A HEALTHY SOCIETY: WHEN TRAUMA AFFECTS GROUP IDENTITY 1874

REVIEW ARTICLE

PREECLAMPSIA AND ITS EFFECT ON THE STATE OF CARDIOVASCULAR SYSTEM IN WOMEN

DOI: 10.36740/WLek202308118

Liudmyla A. Vygivska¹, Natalia V. Derevianchenko¹, Lesia A. Rudenko², Oleh R. Chebotenko¹¹KHARKIV NATIONAL MEDICAL UNIVERSITY, KHARKIV, UKRAINE²ALUNA PUBLISHING HOUSE, KONSTANCIN-JEZIORNA, POLAND

ABSTRACT

The aim: To determine the features of the impact of preeclampsia on the development of cardiovascular disorders in women in the future.

Materials and methods: The study involved an assessment of literary sources, which were published mainly in the last five years, using scientometric and specialized databases Pubmed, Science direct, Scopus, Web of Science, Google Scholar and V.I. Vernadskyi NLU "Scientific Periodicals of Ukraine".

Conclusions: Cardiovascular disorders are not only a medical problem, but also a social one. Preeclampsia is a dangerous condition that contributes to the development of CVDs, increases the rate of mortality and disability among women. All this makes it absolutely necessary to study the features of the pathogenesis in detail, to understand exactly how, through which mechanisms, the preeclamptic state affects the woman's body, and this will allow doctors to indirectly influence its pathogenesis and reduce negative consequences and improve the quality of life.

KEY WORDS: preeclampsia, cardiovascular diseases, risk of development, pathogenic links, cardiovascular biomarkers

Wiad Lek. 2023;76(8):1826-1830

INTRODUCTION

Cardiovascular diseases rank first among all causes of disability and mortality of the population. Arterial hypertension (AH), as the most common representative of this cohort of diseases, occupies a special place among the most pressing issues of medicine in general and the medico-social well-being of mankind. To date, an increase in the mortality rate from cardiovascular diseases (CVDs) has been noted in women, both individually and in comparison with men. Cases of cardiovascular impairments have become more frequent among women of young age (from 25 to 35 years), but the causes of their development are at the stage of consideration [1]. An opinion is expressed about the connection of CVDs in women with pregnancy and its pathological conditions [2]. Since pregnancy is a special stage of a woman's life and is a "stress test" for all body systems, its complications can become powerful inducers of the development of various somatic diseases, even in healthy young women [3].

THE AIM

To determine the features of the impact of preeclampsia on the development of cardiovascular disorders in women in the future.

MATERIALS AND METHODS

The study involved an assessment of literary sources, which were published mainly in the last five years, using scientometric and specialized databases Pubmed, Science direct, Scopus, Web of Science, Google Scholar and V.I. Vernadskyi NLU "Scientific Periodicals of Ukraine".

REVIEW AND DISCUSSION

Preeclampsia (PE) is a complication of pregnancy, which is considered a multisystem abnormal process with characteristic manifestations in the form of arterial hypertension (an increase in arterial systolic pressure ≥ 140 mmHg and diastolic pressure ≥ 90 mmHg) and proteinuria (significant ≥ 0.3 g per day), developing after the 20th week of pregnancy. PE has a complex pathophysiological mechanism, and is currently not fully understood. Currently, the main links of the pathogenesis of this abnormality are considered to be as follows: endothelial dysfunction, changes in the reactivity of the immune system, metabolic transformations with the formation of oxidative stress, features of lipid metabolism, changes in the concentration of cytokine components, activation of the primary links of inflammation, etc. [4-7].

Why is preeclampsia of interest not only to obstetricians and gynecologists, but also to related specialists? Because it is characterized by the development of very serious complications, such as eclampsia (E), acute renal failure (ARF), HELLP syndrome, malignant arterial hypertension. But doctors do not always pay timely attention to the first manifestations of this grave disorder, which can rightfully be considered an inducer of the development of cardiovascular diseases [8].

The opinions of advanced obstetric schools, foreign and domestic scientists, and the European Society of Cardiology agree that the course of preeclampsia provokes the development of cardiovascular diseases, and subsequently chronic diseases of other organs and systems. [9-11].

In this regard, the American Heart Association included PE among the risk factors for the development of cardiovascular diseases (CVDs) in women [12-14].

CVD development is underlain by common pathogenic links of PE advancement, therefore, it is necessary to specify their definition, which will make it possible to prevent their occurrence and reduce the risk of CVD in a specific woman and in the population as a whole [15].

It is well known that pregnancy is stressful for the mother's body, and the development of obstetric complications in the future can increase the risk of developing CVDs. Research in recent years confirms the presence of long-term cardiovascular complications in women who had preeclampsia during pregnancy. Thus, women with a history of preeclampsia have an increased risk of such future CVDs as chronic hypertension, heart failure, stroke, coronary heart disease, and cardiovascular mortality [16-17]. Yes, according to A. I. Lokki et al. [18], women with preeclampsia without CVD risk factors 90 days postpartum had twice the risk of CVDs as manifested by coronary artery revascularization, cerebrovascular disease, or peripheral artery disease. At the same time, in women with a history of preeclampsia and metabolic syndrome, this risk increased almost 12 times. According to the results of a study by British scientists, in women with preeclampsia, the overall frequency of the first cardiovascular events within nine years after childbirth was 2.77% compared to women after an uncomplicated pregnancy (1.4%) [19]. Another evidence of such a relationship is that, according to current recommendations, pregnancy history is part of the routine assessment of CVD risk in women [20]. Therefore, maladaptation of the cardiovascular system during pregnancy increases the tendency to develop CVDs in the postpartum period.

Currently, several pathways are known regarding the etiological relationship between preeclampsia and CVDs. On the one hand, it has been suggested that pre-

eclampsia can be a predictor of cardiovascular events through various pathways [21]. On the other hand, the relationship between future CVDs and preeclampsia is partially explained by the common risk factors: dyslipidemia, insulin resistance, diabetes, obesity, endothelial dysfunction, increased inflammatory reactions, hypercoagulation states [22].

According to modern concepts, preeclampsia results from hypoperfusion and hypoxia of the placenta, occurring due to the improper development of the uterine placental spiral arteries. These conditions trigger an inflammatory reaction, which can cause endothelial dysfunction and vasoconstriction, mediating the risk of future CVDs [23-24].

According to G. Kalapotharakos et al. [25], it is vascular mechanisms, as opposed to cardiac hypertrophy, that may cause increased long-term cardiovascular risk after preeclampsia. A. R. Markovitz et al. [26] showed the etiological relationship between the development of pregnancy complications and disorders of the functioning of the cardiovascular system, manifested by metabolic syndrome, vascular dysfunction or inflammation.

Preeclampsia is characterized by an abnormal rearrangement of placental vessels, causing uteroplacental ischemia. Under such conditions, spiral arteries do not undergo physiological transformation, maintaining thick walls with a narrow lumen. Such remodeling of spiral arteries accelerates maternal blood flow in the intervillous space. Maternal blood flow, which speed is approximately 1–2 m/s, is characterized by a strong impulse, resulting in destruction of villi and formation of an echogenic cystic lesion lined with blood clots, which can enter the mother's body [27]. At the same time, the failure of remodeling leads to a repeated cycle of placental ischemia/reperfusion and causes endothelial dysfunction, changes vascular tone, increases the formation of reactive oxygen species (ROS), the release of inflammatory cytokines, antiangiogenic factors, as well as an imbalance of maternal immune cells [28]. ROS reduce the bioavailability of nitric oxide, which is a proangiogenic factor, as a result of which vasodilation and angiogenesis are disturbed, and the bioavailability of antiangiogenic factors — soluble fms-like tyrosine kinase-1 (sFlt-1) and soluble endoglin (sEng) — increases [29]. sFlt-1 through binding of vascular endothelial growth factor and placental growth factor is associated with defective angiogenesis and endothelial dysfunction, sEng initiates proliferation and migration of endothelial cells. Researchers believe that these antiangiogenic biomarkers significantly contribute to endothelial damage during pregnancy in the case of preeclampsia, but do not remain elevated after delivery [27]. A. E. Stanhewicz [30] suggests that vascular

damage during preeclampsia persists and contributes to the cascade of CVD development.

Endothelial dysfunction is associated with inflammation, the consequence of which is atherosclerosis. Lipids are deposited in the walls of the spiral arteries of the uterus, which is similar to the early stages of atherosclerosis [31]. According to S. C. A. de Jager et al. [28], in women with preeclampsia, the endothelium does not completely recover, remaining more sensitive to inflammation, as is observed in the case of atherosclerosis. C. Anthoulakis and A. Mamopoulos [32] found that the pulse wave speed and the augmentation index at a heart rate of 75 beats per minute are higher in pregnancies complicated by preeclampsia. The authors believe that assessment of arterial stiffness is a promising tool for risk stratification of cardiovascular complications in the future.

Thus, three important stages of the pathophysiology of preeclampsia have been identified: placental hypoxia and oxidative stress, excessive release of antiangiogenic and proinflammatory factors, and widespread systemic endothelial dysfunction and vasoconstriction [33-34]. There is evidence to suggest that suboptimal trophoblastic invasion causes an imbalance of angiogenic and antiangiogenic proteins, ultimately causing widespread inflammation and endothelial damage, increased platelet aggregation, and thrombotic events with placental infarctions [35].

S. Sławek-Szmyt et al. [36], having conducted a review of studies on the relationship between preeclampsia and the long-term risk of CVDs in mothers, concluded that there are common pathophysiological pathways between them. At the same time, scientists drew attention to insufficient study of intermediate mechanisms (chronic bacterial infections, TNF α) responsible for this association.

Pregnancy often occurs at an early stage of a woman's life, when usually CVDs have not yet been detected. Therefore, the issue of screening and prevention of CVDs in women with preeclampsia arises. In this case, determining the level of cardiovascular biomarkers may be useful for predicting the risk of developing CVDs. Biomarkers such as sFlt-1, placental growth factor, interleukin (IL)-6, IL-6/IL-10 ratio, high-sensitivity cardiac troponin I, activin A, soluble human leukocyte antigen G, pregnancy-associated plasma protein A, and norepinephrine can be potentially suitable for cardiovascular risk stratification after preeclampsia and contribute to the development of prevention strategies [37].

Although a history of preeclampsia is recognized as a specific risk factor for CVDs later in life, it is still unclear how to improve the cardiovascular health of these women. Currently, some guidelines suggest monitoring for hypertension, hyperlipidemia, and diabetes, as well as providing advice on a healthy lifestyle for women with a history of preeclampsia [38]. Further research is needed to determine appropriate monitoring strategies for such women.

CONCLUSIONS

Cardiovascular disorders are not only a medical problem, but also a social one. Preeclampsia is a dangerous condition that contributes to the development of CVDs, increases the rate of mortality and disability among women. All this makes it absolutely necessary to study the features of the pathogenesis in detail, to understand exactly how, through which mechanisms, the preeclamptic state affects the woman's body, and this will allow doctors to indirectly influence its pathogenesis and reduce negative consequences and improve the quality of life.

REFERENCES

1. Vogel B, Acevedo M, Appelman Y et al. The Lancet women and cardiovascular disease Commission: reducing the global burden by 2030. *Lancet*. 2021; 397(10292): 2385-2438. doi: 10.1016/S0140-6736(21)00684-X.
2. Ramlakhan KP, Johnson MR, Roos-Hesselink JW. Pregnancy and cardiovascular disease. *Nat Rev Cardiol*. 2020; 17(11): 718-31. doi: 10.1038/s41569-020-0390-z.
3. McAuliffe FM. Impact of pregnancy on long-term health: Advances in postpregnancy care-An opportunity to improve long-term maternal health. *Int J Gynaecol Obstet*. 2023; 160(1): 4-6. doi: 10.1002/ijgo.14536.
4. Shah DA, Khalil RA. Bioactive factors in uteroplacental and systemic circulation link placental ischemia to generalized vascular dysfunction in hypertensive pregnancy and preeclampsia. *Biochem Pharmacol*. 2015; 95(4): 211-26. doi: 10.1016/j.bcp.2015.04.012.
5. Jim B, Karumanchi SA. Preeclampsia: Pathogenesis, Prevention, and Long-Term Complications. *Semin Nephrol*. 2017; 37(4): 386-397. doi: 10.1016/j.semnephrol.2017.05.011.
6. Kinshella MW, Omar S, Scherbinsky K et al. PRECISE Conceptual Framework Working Group. Maternal nutritional risk factors for preeclampsia incidence: findings from a narrative scoping review. *Reprod Health*. 2022; 19(1): 188. doi: 10.1186/s12978-022-01485-9.
7. Vyhivska L.A. Forecasting, prevention and treatment of preeclampsia in pregnant risk groups [abstract]. Kharkiv: Khark. national med. university. 2009.

8. Williams B, Mancia G, Spiering W et al. Practice Guidelines for the management of arterial hypertension of the European Society of Hypertension and the European Society of Cardiology: ESH/ESC Task Force for the Management of Arterial Hypertension. *J Hypertens.* 2018; 36(12): 2284-2309. doi: 10.1097/HJH.0000000000001961.
9. Ramlakhan KP, Malhamé I, Marelli A et al. Hypertensive disorders of pregnant women with heart disease: the ESC EORP ROPAC Registry. *Eur Heart J.* 2022; 43(38): 3749-61. doi: 10.1093/eurheartj/ehac308.
10. Venetkoski M, Joensuu J, Gissler M et al. Pre-eclampsia and cardiovascular risk: a long-term nationwide cohort study on over 120 000 Finnish women. *BMJ Open.* 2022; 12(12): e064736. doi: 10.1136/bmjopen-2022-064736.
11. Babii NV, Yuzko OM. Pathogenetic features of monitoring the course of preeclampsia in pregnant women and its impact on the cardiovascular system (literature review). *Clinical and experimental pathology.* 2022; 21(80): 50-57. doi:10.24061/1727-4338.XXI.2.80.2022.9.
12. Mosca L, Benjamin EJ, Berra K et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women - 2011 update: a guideline from the American heart association. *Circulation.* 2011; 123(11): 1243-62. doi: 10.1161/CIR.0b013e31820faaf8.
13. Kilpatrick S, Nicklas JM, Rosser ML et al. Cardiovascular Health After Preeclampsia: Patient and Provider Perspective. *J Womens Health (Larchmt).* 2021;30(3):305-313. doi: 10.1089/jwh.2020.8384.
14. Grundy SM, Stone NJ, Bailey AL et al. 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA Guideline on the Management of Blood Cholesterol: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation.* 2019; 139(25): e1082-e1143. doi: 10.1161/CIR.0000000000000625.
15. Phipps EA, Thadhani R, Benzing T, Karumanchi SA. Pre-eclampsia: pathogenesis, novel diagnostics and therapies. *Nat Rev Nephrol.* 2019; 15(5): 275-289. doi: 10.1038/s41581-019-0119-6.
16. Oliver-Williams C, Johnson JD, Vladutiu CJ. Maternal Cardiovascular Disease After Pre-Eclampsia and Gestational Hypertension: A Narrative Review. *Am J Lifestyle Med.* 2021; 17(1): 8-17. doi: 10.1177/15598276211037964.
17. Poon LC, Magee LA, Verlohren S et al. A literature review and best practice advice for second and third trimester risk stratification, monitoring, and management of pre-eclampsia: Compiled by the Pregnancy and Non-Communicable Diseases Committee of FIGO (the International Federation of Gynecology and Obstetrics). *Int J Gynaecol Obstet.* 2021; 154(1): 3-31. doi: 10.1002/ijgo.13763.
18. Lokki AI, Daly E, Triebwasser M et al. Protective Low-Frequency Variants for Preeclampsia in the Fms Related Tyrosine Kinase 1 Gene in the Finnish Population. *Hypertension.* 2017; 70(2): 365-371. doi: 10.1161/HYPERTENSIONAHA.117.09406.
19. Leon LJ, McCarthy FP, Direk K et al. Preeclampsia and Cardiovascular Disease in a Large UK Pregnancy Cohort of Linked Electronic Health Records: A CALIBER Study. *Circulation.* 2019; 140(13): 1050-1060. doi: 10.1161/CIRCULATIONAHA.118.038080.
20. Visseren FLJ, Mach F, Smulders YM et al. ESC National Cardiac Societies; ESC Scientific Document Group. 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice. *Eur Heart J.* 2021; 42(34): 3227-37. doi: 10.1093/eurheartj/ehab484.
21. Wu P, Haththotuwa R, Kwok CS et al. Preeclampsia and Future Cardiovascular Health: A Systematic Review and Meta-Analysis. *Circ Cardiovasc Qual Outcomes.* 2017; 10(2): e003497. doi: 10.1161/CIRCOUTCOMES.116.003497.
22. Minhas AS, Ying W, Ogunwole SM et al. The Association of Adverse Pregnancy Outcomes and Cardiovascular Disease: Current Knowledge and Future Directions. *Curr Treat Options Cardiovasc Med.* 2020; 22(12): 61. doi: 10.1007/s11936-020-00862-6.
23. Rana S, Lemoine E, Granger JP, Karumanchi SA. Preeclampsia: pathophysiology, challenges, and perspectives. *Circ Res.* 2019;124(7):1094-12. doi: 10.1161/CIRCRESAHA.118.313276.
24. Melchiorre K, Giorgione V, Thilaganathan B. The placenta and preeclampsia: villain or victim? *Am J Obstet Gynecol.* 2022; 226(2S): S954-S962. doi: 10.1016/j.ajog.2020.10.024.
25. Kalapotharakos G, Salehi D, Steding-Ehrenborg K et al. Cardiovascular effects of severe late-onset preeclampsia are reversed within six months postpartum. *Pregnancy Hypertens.* 2020; 19: 18-24. doi: 10.1016/j.preghy.2019.12.005.
26. Markovitz AR, Stuart JJ, Horn J et al. Does pregnancy complication history improve cardiovascular disease risk prediction? Findings from the HUNT study in Norway. *Eur Heart J.* 2019; 40(14): 1113-20. doi: 10.1093/eurheartj/ehy8603.
27. Odukoya SA, Moodley J, Naicker T. Current Updates on Pre-eclampsia: Maternal and Foetal Cardiovascular Diseases Predilection, Science or Myth? : Future cardiovascular disease risks in mother and child following pre-eclampsia. *Curr Hypertens Rep.* 2021; 23(3): 16. doi: 10.1007/s11906-021-01132-x.
28. de Jager SCA, Meeuwssen JAL, van Pijpen FM et al. Preeclampsia and coronary plaque erosion: Manifestations of endothelial dysfunction resulting in cardiovascular events in women. *Eur J Pharmacol.* 2017; 816: 129-137. doi: 10.1016/j.ejphar.2017.09.012.
29. Turbeville HR, Sasser JM. Preeclampsia beyond pregnancy: long-term consequences for mother and child. *Am J Physiol Renal Physiol.* 2020; 318(6): F1315-F1326. doi: 10.1152/ajprenal.00071.2020.
30. Stanhewicz AE. Residual vascular dysfunction in women with a history of preeclampsia. *Am J Physiol Regul Integr Comp Physiol.* 2018; 315(6): R1062-R1071. doi: 10.1152/ajpregu.00204.2018.
31. Staff AC, Fjeldstad HE, Fosheim IK et al. Failure of physiological transformation and spiral artery atherosclerosis: their roles in preeclampsia. *Am J Obstet Gynecol.* 2022; 226(2S): S895-S906. doi: 10.1016/j.ajog.2020.09.026.

32. Anthoulakis C, Mamopoulos A. Augmentation index and pulse wave velocity in normotensive versus preeclamptic pregnancies: a prospective case-control study using a new oscillometric method. *Ann Med.* 2022; 54(1): 1-10. doi: 10.1080/07853890.2021.2014553.
33. de Alwis N, Binder NK, Beard S et al. Novel approaches to combat preeclampsia: from new drugs to innovative delivery. *Placenta.* 2020; 102: 10-16. doi: 10.1016/j.placenta.2020.08.022.
34. Tanko OP, Vyhivska LA, Blagoveshchenskyi EV. Influence of regulators of cellular metabolism on vascular tone in preeclampsia in pregnant women at risk. *Women's health.* 2007; 1(29): 89-91.
35. Rolnik DL, Nicolaides KH, Poon LC. Prevention of preeclampsia with aspirin. *Am J Obstet Gynecol.* 2022; 226(2S): S1108-S1119. doi: 10.1016/j.ajog.2020.08.045.
36. Sławek-Szmyt S, Kawka-Paciorkowska K, Cieplucha A et al. Preeclampsia and Fetal Growth Restriction as Risk Factors of Future Maternal Cardiovascular Disease-A Review. *J Clin Med.* 2022; 11(20): 6048. doi: 10.3390/jcm11206048.
37. Bovee EM, Gulati M, Maas AH. Novel Cardiovascular Biomarkers Associated with Increased Cardiovascular Risk in Women With Prior Preeclampsia/HELLP Syndrome: A Narrative Review. *Eur Cardiol.* 2021; 16: e36. doi: 10.15420/ecr.2021.21.
38. Gamble DT, Brikinns B, Myint PK, Bhattacharya S. Hypertensive Disorders of Pregnancy and Subsequent Cardiovascular Disease: Current National and International Guidelines and the Need for Future Research. *Front Cardiovasc Med.* 2019; 6: 55. doi: 10.3389/fcvm.2019.00055.

ORCID and contributionship:

Liudmyla A. Vygivska: 0000-0002-9389-4845 ^{A,D,F}

Natalia V. Derevianchenko: 0000-0002-0653-9440 ^{B,F}

Lesia A. Rudenko: 0000-0003-0556-8263 ^{B,E}

Oleh R. Chebotenko: 0000-0002-5789-6341 ^{D,F}

Conflict of interest:

The Authors declare no conflict of interest.

CORRESPONDING AUTHOR

Liudmyla A. Vygivska

Kharkiv National Medical University

4 Nauky Avenue, 61000 Kharkiv, Ukraine

e-mail: liudmilavygovskaya@gmail.com

Received: 03.03.2023

Accepted: 25.07.2023

A - Work concept and design, **B** - Data collection and analysis, **C** - Responsibility for statistical analysis, **D** - Writing the article, **E** - Critical review, **F** - Final approval of the article

 Article published on-line and available in open access are published under Creative Common Attribution-Non Commercial-No Derivatives 4.0 International (CC BY-NC-ND 4.0)