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Diagnostics of hemostasiological indicators of blood in patients with cervical cancer: standards, innovative models of the future (Ukraine)

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Abstract

This article focused on "Diagnostics of hemostasiological indicators of blood in patients with cervical cancer: standards, innovative models of the future (Ukraine)".

Aims: The aims of this study are to investigate the current standards, the innovative models, prognostic and predictive value of hemostasiological indicators of blood in patients with cervical cancer and identifications of potential gaps and opportunities in the current standards and innovative models for hemostasiological assessment.

Methodology: A descriptive cross-sectional study design was evaluated. Secondary data were collected. Descriptive statistics were obtained and utilised.

Results: The result showed that in 2020, Ukraine had 20.3 new cervical cancer cases per 100,000 women, regardless of age. Age-standardised cervical cancer incidence was 14.3 per 100,000 women. In 2020, Ukraine's lifetime cervical cancer risk was 1.4%. It illustrates cervical cancer risk. Prothrombin Time is 11–14 seconds, Activated Partial Thromboplastin Time is 25–35 seconds, fibrinogen is 200–400 mg/dL, and platelet counts are 150,000–450,000/L. Thromboelastography is a viscoelastic test that dynamically assesses blood clot formation, strength, and lysis. This test helps doctors assess cervical cancer patients' haemostatic profile and thrombotic risk and establish thromboprophylaxis regimens. In advanced cervical cancer patients, prothrombin time, APTT, fibrinogen, D-dimer, and platelet count predict thrombotic events and poor prognosis. These signs extend VTE risk. Potential gaps or opportunities include a lack of established practices, few complicated hemostasiological tests, little research, lack of knowledge and teaching, and difficulties with monitoring and follow-up, especially in resource-poor areas. Standardising techniques, expanding access to cutting-edge hemostasiological tests, and remote monitoring, and running education and awareness campaigns are future potentials for research and development.

Scientific Novelty: cutting-edge hemostasiological tests in cervical cancer.

Conclusion: In conclusion, resolving global cervical cancer mortality disparities needs healthcare, cancer prevention, screening, awareness, socioeconomic variables, and creative hemostasiological evaluation models. Better care, thromboprophylaxis, and collaboration can improve cervical cancer outcomes worldwide.

Keywords: cervical cancer; hemostasiological indicators; blood diagnostics; standards; innovative models; Ukraine

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Introduction

Cervical cancer is a type of cancer that affects the cervix, which is the lower part of the uterus that connects to the vagina. The human papillomavirus (HPV), which is passed from partner to partner via sexual contact, is the most frequent cause of cervical cancer. Regular screening exams, like a Pap test or an HPV test, which may identify abnormal cells in the cervix before they become cancerous, can often prevent cervical cancer. If aberrant cells are discovered, a course of therapy may be given to prevent them from developing into cancer. Abnormal vaginal bleeding, such as bleeding between periods or after sex, pelvic pain or discomfort, and atypical vaginal discharge are all potential symptoms of cervical cancer. Patients diagnosed with cervical cancer may see alterations in the hemostasiological (blood clotting) signs that are present in their bodies. The diagnosis of these indications is essential for determining the likelihood of bleeding or thrombosis (the process of blood clotting) and for directing decision-making about therapy. Platelet count, prothrombin time, and other typical hemostasiological markers are some of the things that may be assessed in people who have cervical cancer. These signs are able to be examined in the laboratory, and the results may assist medical professionals in determining the most appropriate course of therapy for people afflicted with cervical cancer.

Globally, it is the fourth most frequent malignancy in women. It is the most common cause of mortality among women. Statistics showed that about 90% of worldwide mortality in 2020 was attributable to new cases and deaths in nations with low or middle incomes. This highlighted the importance of this cancer. There are two human papillomavirus types, 16 and 18, and these are responsible for over 50% of high-grade cervical pre-cancers. Women with HIV are six times more likely to get cervical cancer than those without the infection. Primary prevention, early diagnosis, and prompt treatment help prevent cervical cancer at a fair cost. Cervical cancer may be cured if it is found early and treated well [1]. A chronic human papillomavirus infection in women is one of the key risk factors for cervical cancer. The cure rate for cervical cancer in women who get an early diagnosis varies from 80% to 95% [2–4].

In Ukraine, there are 20.1 million women who are at least 15 years old and at risk of developing cervical cancer. The illness now claims the lives of 2089 women annually, while 4756 other people are diagnosed with it. Cervical cancer is the fourth most prevalent cancer in women overall and the second most common cancer in women in Ukraine between the ages of 15 and 44. In spite of excellent screening and vaccination, invasive cervical cancer incidence and mortality have been steadily declining, yet it is still the most prevalent cause of death from cancer among women in Ukraine [5].

Cervical cancer is prevalent all over the world, especially in developing countries. 9.7% of women in the overall population of Eastern Europe are infected. Furthermore, cervical HPV-16 or 18 infections are accountable for 84.7% of invasive cervical cancers [6,7].

This is crucial to diagnosing a case, and the stage is decided for treatment purposes. The staging of cervical cancer is done using the International Federation of Gynaecology and Obstetrics classification of cervical cancer. Treatment is initially followed by a radical hysterectomy, which is then followed by radiation or chemotherapy, depending on the pathology report. However, the staging of cervical cancer can be unreliable, particularly in cases with advanced disease. Therefore, to categorise risks and direct therapies, accurate and available prognostic biomarkers are required. Currently, a number of serum indicators, including prothrombin time, aPTT, D-dimer, thrombocytosis, and haemoglobin, are being utilised to predict cancer progression [8–10]. In recent years, there has been a steadily growing amount of interest in the analysis of hemostasiological blood parameters in patients with cervical cancer. Prothrombin time, activated partial thromboplastin time, fibrinogen, D-dimer, and platelet count are some of the markers often used to evaluate cervical cancer patients' haemostatic status and anticipate thrombotic events [11–13].

The results of a retrospective investigation on patients with cervical cancer showed that a higher D-dimer level independently predicted an increased risk of venous thromboembolism. D-dimer levels and other clinical factors are taken into account by the Khorana grading system. In patients with cervical cancer and other cancers, this score system has been extensively used to determine the likelihood of venous thromboembolism (VT) and direct thromboprophylaxis strategies [14–16].

Rotational thromboelastometry (ROTEM) and thromboelastography (TEG) are point-of-care viscoelastic devices that evaluate fibrinolysis and coagulation using whole blood samples. Although these devices have undergone extensive research in cardiac surgery, there is only weak evidence to support their use in obstetrics. In addition to the current criteria of using common hemostasistical tests like PT, aPTT, several novel models have been proposed for the assessment of hemostasiological indicators of blood in cervical cancer patients in Ukraine. These models give new insights on the pathophysiology of haemostasis in cervical cancer and are intended to improve the precision and accuracy of hemostatic evaluation. A full assessment of the coagulation process, including clot formation, clot strength, and fibrinolysis, is provided by the TEG, one of the viscoelastic tests. These aid in assessing the risk of venous thromboembolism (VT) and direct thromboprophylaxis techniques in the treatment of cervical cancer patients. [17–19].

The high cervical cancer incidence and mortality rates in Ukraine, especially among reproductive-age women, warrant the examination. Despite HPV vaccination and screening, cervical cancer is the leading cancer killer in Ukraine, underscoring the need for greater research and treatments. Ukrainian women are infected with high-risk HPV strains such as HPV-16 and HPV-18, highlighting the importance of blood hemostasiological indicators in cervical cancer patients. This study may alter cervical cancer treatment in Ukraine and other high-burden nations. Cervical cancer prognostic markers may help stratify risk and guide treatment in resource-limited settings. This study may also help develop standards for monitoring blood hemostasiological symptoms in cervical cancer patients in Ukraine to standardise clinical practise and improve patient care. In conclusion, a study on blood hemostasiological indicators in cervical cancer patients in Ukraine is warranted due to the high burden of the disease, the potential impact of haemostasis on patient outcomes, and the need for innovative models to improve hemostasiological assessment accuracy and precision. This work may help establish prognostic biomarkers, guidelines, and recommendations for cervical cancer management in Ukraine and other countries, improving patient outcomes.

Research Problem

Variability in criteria for blood hemostasiological markers, such as PT, aPTT, fibrinogen, D-dimer, and platelet count, may have an impact on the diagnosis and treatment of cervical cancer patients in Ukraine. Therefore, the research problem is:

1. To critically review the current standards for hemostasiological indicators of blood in patients with cervical cancer.
2. To identify the potential gaps or limitations and opportunities in the current practices.
3. To explore innovative models for the assessment of hemostasiological indicators of blood and evaluate their prognostic and predictive value in cervical cancer patients in Ukraine.

Research Focus

The focus of this study is to evaluate critically the existing norms for hemostasiological markers of blood in patients with cervical cancer in Ukraine and to highlight new, creative models. The goal of the study is to assess these hemostasiological variables' prognostic and predictive significance in cervical cancer patients, including their ability to foretell thrombotic episodes and inform thromboprophylaxis plans. Additionally, the study will suggest future paths for clinical practice and research in this field and highlight any potential flaws or restrictions in the creative models and current standards for hemostasiological evaluation in cervical cancer patients in Ukraine.

Research Aim and Research Questions

Aims and objectives of research are to study:

1. The current standards for hemostasiological indicators of blood in patients with cervical cancer in Ukraine.
2. The innovative models that have emerged for the assessment of hemostasiological indicators of blood in cervical cancer patients in Ukraine.
3. The prognostic and predictive value of hemostasiological indicators of blood in cervical cancer patients, including their role in predicting thrombotic events and guiding thromboprophylaxis strategies.
4. The potential gaps or limitations and opportunities in the current standards and innovative models for hemostasiological assessment.

Research Questions

1. What are the current standards for hemostasiological indicators of blood in patients with cervical cancer in Ukraine?
2. What innovative models have emerged for the assessment of hemostasiological indicators of blood in cervical cancer patients in Ukraine?
3. What is the prognostic and predictive value of hemostasiological indicators of blood in cervical cancer patients?
4. What potential gaps or limitations and opportunities exist in the current standards and innovative models for hemostasiological assessment in cervical cancer patients in Ukraine?

Research Methodology

General Background

Particularly in Ukraine, where the disease ranks as the second most common condition among women between the ages of 15 and 44, cervical carcinoma is a serious public health problem. Blood hemostasiological signs are critical in the diagnosis and management of cervical cancer patients. Haemostasis is the complex process that governs blood clotting and requires a delicate balance of procoagulant and anticoagulant substances. Changes in hemostasiological parameters can increase the risk of thrombosis or bleeding, which can have serious clinical consequences for cervical cancer patients. The findings of this study could help to establish prognostic biomarkers, specifications, and recommendations for cervical cancer management in Ukraine and other comparable settings, resulting in better outcomes for cervical cancer patients.

Data Analysis

A descriptive cross-sectional study methodology was utilised. For the purpose of gathering data, a questionnaire was used. Using both online and offline techniques, secondary data was gathered for the questionnaire from official sources and public data. Both types of data (quantitative and qualitative) were gathered. The study results were shown in the form table. Qualitative data was presented in the form of frequencies or percentages. Qualitative data was shown in the form of nominal data. There was no data analysis and just a data comparison in the discussion part.

Research Results

Status of cervical cancer

The results in (Table 1) showed that the data on cervical carcinoma in Ukraine provide an overview of the disease's impact there, including the prevalence of new cases, fatalities, and overall risk of contracting the disease. They may be helpful for comprehending how cervical cancer affects the populace and guiding public health policies and measures to lessen the disease's burden.

Table 1. Ukraine's status in Cervical Cancer

Variables	Frequency
Crude Cervical Cancer Deaths	2,434 per 100 000 women
Proportionate mortality rate of CC to total deaths	0.44%
Age adjusted Death Rate	7.04 per 100,000 population
Cervical cancer incidence	20.3 per 100 000 women
Age-standardised cervical cancer incidence	14.3 per 100 000 women
Cumulative risk of cervical cancer, ages 0-74	1.4%
Cervical cancer mortality-to-incidence ratio	0.44

Source: Authors' development based on cervical cancer Ukraine 2021 country profile n.d.

The number of new cases of cervical cancer diagnosed was 20.3 per 100,000 women in Ukraine in 2020, without taking into account age differences or other factors. It reflects the overall burden of cervical cancer in the population while Age-standardized cervical cancer incidence was 14.3 per 100,000 women in 2020, similar to the crude incidence rate, but it is age-standardized, which means that it takes into account the age distribution of the population. It allows for comparison of cervical cancer rates between different populations or countries with varying age distributions. Cumulative risk of cervical cancer, among ages 0-74 were1.4% in 2020 represents the estimated lifetime risk of developing cervical cancer from birth until the age of 74 in Ukraine. It indicates the likelihood of a woman in Ukraine developing cervical cancer during her lifetime. Cervical cancer mortality-to-incidence ratio was 0.44 in 2020 represents the proportion of cervical cancer deaths compared to the number of new cases diagnosed in Ukraine in 2020. A lower ratio indicates a lower mortality rate relative to the incidence of cervical cancer, which may suggest better survival outcomes. Population-based cancer registry exists as of 2021 indicates that Ukraine has a population-based cancer registry, which is a database that collects and records information on cancer cases in a defined population. It is an important tool for monitoring cancer incidence, mortality, and trends over time. Total female population in 2019 was 23,610,000 represents the total number of females in Ukraine in 2019, which is the population at risk for cervical cancer while total female deaths in 2019 were 300,000, which includes all causes of death, including cervical cancer. The absence of a government immunisation program and women's disinterest in routine screening and treatment are the main causes of cervical cancer in Ukraine. According to the most recent WHO statistics, 2,434 women in Ukraine died from cervical cancer in 2020, accounting for 0.44 percent of all fatalities. Ukraine is ranked #106 in the world by age-adjusted Death

Rate (7.04 per 100,000 of Population). Click on the links below to review more causes of death, or choose the complete health profile [20,21].

In conclusion, the statistics on cervical cancer in Ukraine provide important information about the severity of the disease there. According to estimates from 2020, a woman in Ukraine had a cumulative risk of 1.4% of acquiring cervical cancer between the ages of 0-74, which represents her lifetime risk of contracting the disease. The death-to-incidence ratio for cervical cancer in 2020, which was 0.44, indicates a considerably lower mortality rate when compared to the incidence rate, which could indicate better survival results. Furthermore, a population-based cancer registry is essential for observing cancer incidence, mortality, and long-term trends in Ukraine. The lack of a government immunisation programme and the poor rates of compliance with routine screening and treatment among women are the country's two biggest problems, though. Addressing these issues is crucial for lowering the incidence of cervical cancer in Ukraine and enhancing women's health outcomes. Promoting routine screening and treatment as well as putting into place efficient public health initiatives like vaccination campaigns will help prevent cervical cancer and increase survival rates. Ukraine may take action to lessen the effects of cervical cancer and enhance the general health and wellbeing of its female population by addressing these issues.

Current standards for hemostasiological indicators of blood in patients with cervical cancer

Results (Table 2) demonstrated that the normal range of the prothrombin time test value is 11–14 seconds, which is the normal reference range and potential predictive value for routinely measured hemostasiological indicators of blood in patients with cervical cancer in Ukraine.

Table 2. Hemostasiological indicators of blood in patients with cervical cancer in Ukraine

Hemostasiological Indicator	Value
Prothrombin Time	11-14 seconds
Activated Partial Thromboplastin Time	25-35 seconds
Fibrinogen	200-400 mg/dL
D-dimer	< 500 ng/mL or negative result
Platelet count	150,000-450,000 platelets/μL

Source: Authors' development based on Journal of Experimental and Clinical Medicine n.d.

Prolongation may indicate weakened clotting factors involved in the extrinsic route of the coagulation cascade in conditions such as liver illness, vitamin K insufficiency, or DIC. The Activated Partial Thromboplastin Time reference range is typically 25 to 35 seconds. In diseases like haemophilia, von Willebrand disease, or DIC, prolongation may be a sign that clotting components involved in the intrinsic pathway of the coagulation cascade are impaired. The typical range for fibrinogen is 200–400 mg/dL. Abnormal levels could be a sign of DIC, consumptive coagulopathies, or liver illness, among other disorders. 500 ng/mL, or a negative result, is the D-dimer normal range. Increased levels could be a sign of continuous clot disintegration, which is found in diseases such as venous thromboembolism, or DIC. The range of normal platelet counts is 150,000–450,000/L. A few illnesses that may be suggested by aberrant counts are thrombocytopenia (with a low platelet count) and thrombocytosis (with a high platelet count) [22–24]. The haemostatic status of these patients can be assessed by their PT, aPTT, fibrinogen, D-dimer, and platelet counts. These indications can indicate liver illness, vitamin K deficiency, DIC, haemophilia, von Willebrand disease, consumptive coagulopathies, or thromboembolic events. These findings highlight the need for monitoring hemostasiological markers in Ukrainian cervical cancer patients to assess clotting function and identify coagulation abnormalities. These findings may affect cervical cancer treatment, including coagulation problems and thrombotic events. These hemostasiological indications can help cervical cancer patients identify and treat aberrant clotting issues early, increasing their prognosis. In conclusion, understanding the normal reference ranges and potential predictive values of hemostasiological indicators in cervical cancer patients in Ukraine will help clinicians manage coagulation-related problems. These hemostasiological variables may affect cervical cancer patient outcomes, hence, more studies and clinical trials are needed.

The innovative models for the assessment of hemostasiological indicators of blood in cervical cancer patients

The result in (Table 3 summarises a few of the novel approaches that have been developed for the evaluation of hemostasiological markers of blood in Ukrainian patients with cervical cancer: a viscoelastic test called

thromboelastography offers a dynamic evaluation of the entire blood clotting process, including clot formation, strength, and lysis. With the use of this test, doctors can better understand the haemostatic profile and thrombotic risk of cervical cancer patients and develop tailored thromboprophylaxis plans. The TEG parameters are examined by the TEG analysis software. The TEG parameters include R-time, which gauges how long it takes for the first fibrin to form after the test begins, K-time, which gauges how long it takes for the graph to amplify to 20 mm, angle, which gauges how quickly clots form, maximum amplitude, which gauges how strong clots are, with fibrinogen and platelets accounting for 20% and 80% of clot strength, respectively, and coagulation index, which is a calculated [25]. This innovative approach has also been applied to research on coagulopathy brought on by cancer [26] and has expanding clinical roles. 23 recommendations and 7 best practices for cervical cancer screening and treatment have been published by the WHO in a guideline [27].

Table 3. Innovative models for the assessment of hemostasiological indicators of blood in cervical cancer patients

Innovative hemostasiological Models
Thromboelastography (TEG)
Rotational thromboelastometry (ROTEM)
Microparticle-based assays
Global clotting assays (GCAs)

Source: Authors' development based on WHO n.d.

Rotational thromboelastometry is a different viscoelastic assay that may be helpful in determining the haemostatic condition and directing thromboprophylaxis in patients with cervical cancer. The traditional coagulation tests in vascular tissue surgery may be supplemented by this approach. This can be used in conjunction with TEG to foresee hypercoagulable conditions and thromboembolic consequences in cancer patients. Numerous studies indicate that ROTEM may be an effective technique for treating cervical cancer patients [28,29].

Microparticle-based assays are based on small vesicles produced by active or apoptotic cells. They are called microparticles, and they can be used as indicators of haemostatic and procoagulant activity in an assay. To measure the quantity and activity of procoagulant microparticles, such as tissue factor-positive microparticles, in cervical cancer patients, numerous microparticle-based tests have been created [30].

Global clotting assays (GCAs) are tests that offer a thorough evaluation of the blood's total clotting function and fibrinolytic activity. These tests take into account factors like clotting time, clot formation, clot strength, and clot lysis. This model aids in guiding thromboprophylaxis measures and offers vital information on the haemostatic status and thrombotic risk of cervical cancer patients [31].

It is very important to note that the comprehension of these innovative models or approaches should be done in conjunction with the clinical context, the characteristics of the patient, and any other relevant variables and should be based on validated reference ranges or guidelines that are specific to the population that is being studied. In order to determine the utility and therapeutic importance of these unique models for the assessment of hemostasiological variables in cervical cancer patients in Ukraine, additional research and validation studies may be required.

The prognostic and predictive value of hemostasiological indicators of blood in cervical cancer patients

The findings of a research study (Table 4) demonstrated the prognostic and predictive utility of hemostasiological blood markers in cervical cancer patients, as well as their function in foretelling thrombotic events and directing thromboprophylaxis techniques. Patients with advanced cervical cancer have a bad prognosis when their prothrombin time is high. a marker for individuals with cervical cancer who are at higher risk of thrombotic events. An elevated risk of VTE is indicated by prolongation, which may direct the use of thromboprophylaxis techniques. Patients with advanced cervical cancer have a bad prognosis when their Activated Partial Thromboplastin Time is high, a marker for patients with cervical cancer who are at higher risk of thrombotic events. An elevated risk of VTE is indicated by prolongation, which may direct the use of thromboprophylaxis techniques.

Table 4. Prognostic and predictive value of hemostasiological indicators & their role in predicting thrombotic events and guiding thromboprophylaxis strategies:

Hemostasiological indicators	Prognostic Value	Predictive Value	Role in Thrombotic Events	Role in Thromboprophylaxis Strategies
Prothrombin Time	Advanced cervical cancer has a bad prognosis.	Cervical cancer patients' thrombotic risk predictor.	Prolongation raises VTE risk.	May advise thromboprophylaxis.
Activated Partial Thromboplastin Time	Advanced cervical cancer has a bad prognosis.	Cervical cancer patients' thrombotic risk predictor.	Prolongation raises VTE risk.	May advise thromboprophylaxis.
Fibrinogen	Advanced cervical cancer has a bad prognosis.	Cervical cancer patients' thrombotic risk predictor.	Prolongation raises VTE risk.	May advise thromboprophylaxis.
D-dimer	Advanced cervical cancer has a bad prognosis.	Cervical cancer patients' thrombotic risk predictor.	Prolongation raises VTE risk.	May advise thromboprophylaxis.
Platelet count	Advanced cervical cancer has a bad prognosis.	VTE risk increase with thrombocytopenia.	Prolongation raises VTE risk.	May advise thromboprophylaxis.

Source: Authors' development based on Journal of Experimental and Clinical Medicine n.d.

Patients with advanced cervical cancer have a bad prognosis when fibrinogen is present as a marker for patients with cervical cancer who are at higher risk of thrombotic events. An elevated risk of VTE is indicated by prolongation, which may direct the use of thromboprophylaxis techniques. Patients with advanced cervical cancer have a bad prognosis when they have high D-dimer levels. a marker for patients with cervical cancer who are at higher risk of thrombotic events. An elevated risk of VTE is indicated by prolongation, which may direct the use of thromboprophylaxis techniques. Patients with advanced cervical cancer have a bad prognosis when their platelet counts are high. Thrombocytopenia or thrombocytosis, or abnormal platelet counts, may signify a higher risk of VTE. An elevated risk of VTE is indicated by prolongation, which may direct the use of thromboprophylaxis techniques [32,33]. The Negative Predictive Value and Positive Predictive Value (PPV) are used to assess hemostasiological symptoms in cervical cancer patients in Ukraine. When a patient tests negative, there is a probability that they may not have the condition of interest. It demonstrates how a negative test result rules out the illness. A low-test result reliably eliminates the condition, according to a high NPV. The probability that a patient with a positive test result has the desired condition is known as PPV. A positive test result may predict the emergence of the disorder. A high PPV indicates that a positive test result is very reliable in confirming the diagnosis [34]. Hematological markers such as NLR, PLR, and RDW have been shown to have predictive value in patients with cervical cancer. In addition, studies have evaluated the prognostic value of micro vessel density in cervical cancer patients [35]. The results of the current investigation demonstrated the prognostic usefulness of pre-operative measurements of WBC, haemoglobin, lymphocyte, and platelet levels in patients with early cervical cancer. These findings imply that blood's hemostasiological markers might help cervical cancer patients plan their thromboprophylaxis regimens and forecast thrombotic occurrences [36].

In conclusion, advanced cervical cancer patients' thrombotic events and poor prognosis are predicted by the following blood tests: prothrombin time, activated partial thromboplastin time, fibrinogen, D-dimer, and platelet count. These symptoms increase the risk of VTE. These hemostasiological variables may help cervical cancer patients forecast thrombotic episodes and guide thromboprophylaxis. These findings suggest that hemostasiological indicators may help Ukrainian cervical cancer patients manage thrombotic risk. More research is needed to confirm this.

Potential gaps or limitations and opportunities

The findings of the research (Table 5) showed that there was a lack of standardized procedures, limited opportunities for advanced hemostasiological tests, limited research on hemostasiological assessment in cervical cancer patients, a lack of awareness and education, and difficulties in follow-up and monitoring of hemostatic function in cervical cancer patients, particularly in terms of resources. These are possible gaps and limitations within the current standards and innovative models for hemostasiological assessment of cervical cancer patients in Ukraine [36,37].

Table 5. Potential gaps or limitations and opportunities

Potential gaps or limitations	Opportunities
Lack of standardized protocols)	Standardization of hemostasiological assessment protocols

Limited access to advanced hemostasiological tests	Increased access to advanced hemostasiological tests
Limited research on hemostasiological assessment in cervical cancer patients	Conducting research on hemostasiological assessment in cervical cancer patients
Lack of awareness and education	Education and awareness campaigns
Challenges in follow-up and monitoring	Telemedicine and remote monitoring

Source: Authors' development based on Journal of Clinical Medicine 2020 n.d.

Standardising hemostasiological assessment protocols, creating standardised protocols for hemostasiological evaluation, and other opportunities for future research and clinical practise in this field Increasing access to cutting-edge hemostasiological tests, studying hemostasiological evaluation in cervical cancer patients, telemedicine and remote monitoring, education, and awareness campaigns Particularly in locations with limited resources, using telemedicine and remote monitoring technology can help patients with cervical cancer navigate the hurdles of follow-up and monitoring hemodynamic function while also enabling prompt detection and management of haemostatic abnormalities [38].

Despite the fact that hemostasiological assessment has demonstrated potential value in guiding thromboprophylaxis strategies and predicting thrombotic events in cervical cancer patients in Ukraine, there are a number of gaps and restrictions in the present standards and cutting-edge models for hemostasiological assessment in this population. These include a lack of established practices, few possibilities for complex hemostasiological tests, scant research, a lack of knowledge and instruction, and challenges with monitoring and follow-up, particularly in places with scarce resources. Standardising assessment techniques, expanding access to cutting-edge hemostasiological tests, leveraging telemedicine and remote monitoring, and running education and awareness campaigns are some future potentials for research and clinical practise in this area. These techniques might aid in addressing the shortcomings and enhancing hemostasiological evaluation in Ukrainian patients with cervical cancer, which would ultimately improve thrombotic risk management and patient outcomes.

Discussion

Status of cervical cancer

The statistics on cervical cancer in Ukraine contain information on the prevalence, mortality, overall risk, and mortality-to-incidence ratio of the disease. The prevalence of cervical cancer in the population is represented by the crude incidence rate of 20.3 new cases per 100,000 women in 2020, while the age-standardised incidence rate of 14.3 per 100,000 women adjusts for age disparities and enables comparisons between other groups. The low mortality-to-incidence ratio of 0.44 in 2020 and the cumulative risk of 1.4% for having cervical cancer by the age of 74 point to higher survival outcomes. With 2,434 fatalities from cervical cancer accounting for 0.44% of all deaths and an age-adjusted mortality rate of 7.04 per 100,000 people, Ukraine is ranked 106 internationally due to its rather high cervical cancer death rate. Turkey, on the other hand, has a lower death rate from cervical cancer, with 1,311 fatalities representing 0.34% of all fatalities and an age-adjusted death rate of 2.71 per 100,000 people, placing it at 153 internationally. This suggests that, when compared to Turkey, cervical cancer is a bigger public health concern in Ukraine. With 4,378 cervical cancer fatalities, or 2.11% of all deaths, and an age-adjusted death rate of 45.76 per 100,000 people, Uganda has the eighth-highest cervical cancer mortality rate in the world. This indicates that, compared to Ukraine and Turkey, cervical cancer is a major public health concern in Uganda, with a significantly greater burden [39].

In contrast, the United Kingdom has a lower cervical cancer death rate, with 1,099 deaths accounting for 0.21% of total deaths, and an age-adjusted death rate of 2.01 per 100,000 populations, ranking it at 165 globally. This indicates that cervical cancer is comparatively less prevalent as a cause of death in the United Kingdom. Uzbekistan has a moderate cervical cancer death rate, with 840 deaths accounting for 0.52% of total deaths, and an age-adjusted death rate of 5.68 per 100,000 populations, ranking it at 118 globally. Yemen has a relatively low cervical cancer death rate, with 119 deaths accounting for 0.08% of total deaths, and an age-adjusted death rate of 1.52 per 100,000 population, ranking it at 178 globally [40].

Cervical cancer is preventable and treatable, but it kills many people globally. The prompt's cervical cancer death rates and rankings show global differences. Access to healthcare, cancer prevention and screening programs, cervical cancer education, and socioeconomic variables can affect these discrepancies. Healthcare access affects cervical cancer mortality. Low-resource countries may struggle to prevent and treat cervical cancer. Since early detection and treatment improve results, this may increase cervical cancer fatalities. Lack of screening programs, knowledge, and education on early detection, risk reduction, and healthy practises can empower people to prevent cervical cancer and seek urgent medical care. Poverty and inequality can increase cervical cancer fatality disparities. These gaps may necessitate extensive interventions that address social determinants of

health and healthcare equity. This may include strengthening healthcare systems to ensure affordable and quality cervical cancer prevention and treatment services, implementing evidence-based screening and vaccination programs, promoting cervical cancer awareness and education, and addressing socioeconomic factors that contribute to health disparities.

Current standards for hemostasiological indicators of blood in patients with cervical cancer

Understanding the haemostatic condition of cervical cancer patients requires an understanding of the function of prothrombin in blood clotting and coagulation factors. One of the key components that helps blood clot is the protein prothrombin, which is produced by the liver. Clotting factors are a group of proteins that are necessary for normal clotting and must be present in appropriate amounts in order to sustain haemostasis Prothrombin time (PT) is frequently used as a coagulation test in clinical settings to evaluate the blood's capacity to clot. It is typically measured in seconds, and in healthy patients, the normal range is 10 to 14 seconds. Prothrombin activity is often expressed as a percentage, with a normal value above 70%. The International Normalized Ratio (INR), a standardized measurement of PT, is another metric frequently used to evaluate coagulation. In healthy people, the INR should fall between 0.8 and 1.2. The therapeutic interval for INR is typically higher in individuals undergoing oral anticoagulant treatment, ranging from 2.0–3.0 [41].

The assessment of patient treatment and patient prognosis benefited greatly from all of these tests. These tests are being used all around the world. It is noteworthy to note that individuals with cervical cancer have different coagulation properties compared to healthy individuals. This is something that should be kept in mind. A study that was conducted in India found that the levels of fibrinogen, prothrombin time, and activated partial thromboplastin time in cervical cancer patients were much higher than those seen in healthy control participants [42,43] .This shows the importance of using this test for prognosis.

Similar results were found in an Iranian, Korean, and Indonesian investigation, which found that cervical cancer patients had much higher D-dimer levels than healthy controls. As changed levels may indicate a procoagulant state, which may raise the risk of thromboembolic events, these findings imply that evaluating these coagulation parameters may be crucial in determining the haemostatic status of cervical cancer patients [44].

The complete blood count, which may assist in discovering possible prognostic indications for the course of the illness, is a crucial diagnostic tool for patients with cervical cancer. The changes in leukocyte and platelet counts following radiation may reflect the impact of cancer treatment on haematological parameters, whereas pre-treatment CBC may be a good predictive model for recurrence in early cervical cancer. These results underline the need for routine CBC monitoring in cervical cancer patients, as it may provide useful data for disease management and therapy choices. Coagulation parameter measurements, including PT, aPTT, fibrinogen levels, D-dimer levels, and CBC, may offer crucial information about the haemostatic condition of cervical cancer patients. A procoagulant condition or possible prognostic markers for the course of the disease may be indicated by altered values of these measures. Therefore, including these evaluations in the care of cervical cancer patients may help in developing suitable treatment plans and keeping an eye out for any potential coagulation disorder-related side effects. Additional information and suggestions for the management of coagulation parameters in cervical cancer patients may be provided by further study in this area.

The innovative models for the assessment of hemostasiological indicators of blood in cervical cancer patients

Recent years have witnessed substantial improvements in the evaluation of hemostasiological markers of blood in cervical cancer patients. These innovative models include like Thromboelastography (TEG), Rotational thromboelastometry (ROTEM), Microparticle-based assays and Global clotting assays (GCAs). These sophisticated haemostatic assays are being used in numerous nations throughout the world. Ukraine also benefited with these facilities but very limited. Ukraine has encountered difficulties while evaluating hemostasiological markers in cervical cancer patients due to a lack of resources and technological advancements. To evaluate the coagulation state of cervical cancer patients, researchers and doctors in Ukraine have been actively using cutting-edge models, such as TEG and other advanced haemostatic assays [45]. But cervical cancer patients, in developed nations, including the United States, Germany, the United Kingdom, and Italy, have been at the forefront of these developments. TEG has been widely used in the US to offer a thorough assessment of the coagulation state in cancer patients, especially those with cervical cancer, improving patient outcomes. The use of TEG has allowed for a more accurate and personalised approach to managing haemostatic disorders in these patients, leading to improved patient outcomes [46].

Similar to this, nations in Europe like Germany, the United Kingdom, and Italy have also been actively using methods like TEG to evaluate coagulation parameters in patients with cervical cancer, enabling more accurate assessment of haemostatic state and customized treatment plans [47]. These innovative models in Italy have enabled a more accurate evaluation of haemostatic state, permitting customised treatment plans for cervical cancer patients in these nations [48].

There is no doubt that the examination of hemostasiological indicators in cervical cancer patients using novel models, such as TEG and other advanced hemostatic tests, has significantly improved patient outcomes in industrialised countries. These models provide a more precise and individualised method for treating haemostatic problems in these individuals, improving patient outcomes, and the use of TEG has made it possible to create treatment programmes that are specifically tailored to the haemostatic condition being assessed. But there are some points against this as well. The lack of resources and technological advancements has made it challenging for Ukraine to assess hemostasiological markers in cervical cancer patients. Furthermore, their access is still restricted, limiting their usefulness in enhancing patient outcomes. Despite hurdles, Ukraine has adopted these creative methods, focusing on cost-effectiveness, viability in resource-limited contexts, and responsiveness to population demands. Research and international collaboration can improve cervical cancer haemostatic evaluation and patient outcomes.

The prognostic and predictive value of hemostasiological indicators of blood in cervical cancer patients

The findings of the study indicate that hemostasiological indicators of blood in patients with cervical cancer have prognostic and predictive significance in predicting thrombotic events and guiding thromboprophylaxis techniques. This was demonstrated by the fact that the indicators were able to accurately forecast thrombotic occurrences [32,33]. This implies that these indicators can be useful in identifying patients at risk of developing thrombotic events and in designing appropriate thromboprophylaxis strategies to prevent such complications.

Studies have assessed the predictive usefulness of microvascular density in cervical cancer patients in addition to hematological indicators. Angiogenesis, which is a key factor in tumour growth and metastasis, is measured by microvascular density. Higher microvascular density has been linked to a worse prognosis in cervical cancer patients, and its examination can provide further data for outcome prediction and treatment strategy guidance [34]. Micro vascular density is a measure of angiogenesis, which plays a critical role in tumour growth and metastasis. Higher micro vascular density has been associated with poorer prognosis in cervical cancer patients, and its assessment can provide additional information for predicting outcomes and guiding treatment strategies.

Pre-operative assessments of white blood cell, haemoglobin, lymphocyte, and platelet levels have prognostic significance for prognosis in early cervical cancer patients, according to the results of the current study [35]. This shows that these hemostasiological blood markers may be helpful prognostic indicators in cervical cancer patients, assisting in the identification of those who are more likely to experience poor outcomes and thrombotic events [36]. The capacity of a given test to correctly anticipate the presence or absence of a certain disease or result is referred to as the test's predictive value. It is often given as a percentage and is determined by a number of variables, such as the test's sensitivity and specificity, the prevalence of the disease in the population being tested, and the likelihood that the condition would exist in the test subject prior to the test. Positive predictive value (PPV) and negative predictive value (NPV) are the two different forms of predictive values. In contrast, NPV is the likelihood that a negative test result will properly show the absence of the condition. PPV is the likelihood that a positive test result will accurately indicate the existence of the condition. The research also looked at negative predictive value (NPV), which is significant. The NPV calculates the chance that a certain outcome (such thrombotic events) won't happen in the case of a negative test result. A negative test result basically rules out the occurrence if the NPV is large. In the context of hemostasiological indicators of blood in cervical cancer patients, a high NPV would mean that a negative test result may be predictive of a low risk of thrombotic events, aiding in the appropriate direction of thromboprophylaxis strategies [19].

Overall, the study's findings underscore the importance of hemostasiological blood markers in cervical cancer patients for prognostic and predictive purposes. Haematological markers and measurements of angiogenesis are among the indicators that can be useful for forecasting outcomes, identifying patients who are more likely to experience thrombotic events, and directing thromboprophylaxis techniques in the treatment of cervical cancer patients.

Potential gaps or limitations and opportunities

The lack of standardised protocols, limited access to advanced hemostasiological tests, limited research on hemostasiological assessment in cervical cancer patients, a lack of awareness and education, and difficulties in follow-up and monitoring of haemostatic function in cervical cancer patients, particularly in resources, are possible gaps and limitations in the current standards and innovative models for hemostasiological assessment in cervical cancer patients in Ukraine [36,37]. Standardising hemostasiological assessment protocols, creating standardized protocols for hemostasiological evaluation, and other opportunities for future research and clinical practice in this field Increasing access to cutting-edge hemostasiological tests, studying hemostasiological evaluation in cervical cancer patients, telemedicine and remote monitoring, education and awareness campaigns: Particularly in locations with limited resources, using telemedicine and remote monitoring technology can help patients with cervical cancer navigate the hurdles of follow-up and monitoring haemostatic function while also enabling prompt detection and management of haemostatic abnormalities [38].

In a comparable circumstance, women who wanted to be screened for cervical cancer encountered minor obstacles such as ignorance and lack of access to information, high screening prices, low risk perceptions, and poor health-seeking habits. Unfavourable attitudes and behaviours are also influenced by social networks, sociocultural norms, men's roles, and HIV-related stigma when screening is included in HIV care. Macro-level barriers to cervical cancer screening were inadequate medical facilities and a dearth of national cancer prevention policies [49]. There were the same barriers and opportunities faced by women in Ethiopia as well [50].

Innovative models for hemostasiological assessment in cervical cancer patients in Ukraine and other countries should consider these potential gaps and limitations. Efforts should be made to standardise protocols, improve access to advanced hemostasiological tests, promote research and education, increase awareness among healthcare providers and patients, and address challenges in follow-up and monitoring. Addressing these limitations can help ensure the accurate assessment and management of haemostatic disorders in cervical cancer patients and improve patient outcomes.

Conclusions and Implications

Cervical cancer fatality rates vary worldwide. Healthcare, cancer prevention and screening programs, awareness and education, and socioeconomic factors contribute to these discrepancies. Following are the conclusions and implications of this study:

1. Cervical cancer mortality rates range dramatically between nations, with some bearing a heavier burden than others. Socioeconomic variables, cancer prevention and screening programs, awareness and education campaigns, and access to healthcare are all important contributors.
2. It may be possible to employ coagulation indices, as markers to evaluate the haemostatic status and prognosis of cervical cancer patients.
3. Patients with cervical cancer may show altered coagulation parameters, levels, indicating a procoagulant state and a possible increased risk of thromboembolic events.
4. Haematological variables may be used as potential prognostic markers for the course of the disease in patients with cervical cancer.
5. In affluent nations and Ukraine, cutting-edge models like Thromboelastography (TEG) and other sophisticated haemostatic assays are frequently used to evaluate hemostasiological signs in cervical cancer patients.
6. In spite of obstacles, Ukraine has advanced in implementing novel models for the evaluation of hemostasiological parameters.
7. Haematological markers offer prognostic and predictive utility in forecasting outcomes, increased risk of thrombotic events, and directing thromboprophylaxis techniques.
8. The current standards and models for hemostasiological assessment in cervical cancer patients in Ukraine and other nations may have potential gaps and limitations especially in settings with limited resources.

Implication:

1. The nations with higher cervical cancer death rates, policymakers and healthcare organizations need to provide priority to services for cervical cancer prevention and treatment.
2. To assess cervical cancer patients' risk of thromboembolic events and forecast disease outcomes, healthcare professionals should think about evaluating coagulation markers in these patients.
3. To identify patients with cervical cancer who are more likely to experience thromboembolic events, healthcare professionals should think about evaluating coagulation markers as part of their normal screening.
4. Tracking haematological variables in cervical cancer patients may help in determining if the illness will return or how well the treatment will work.
5. The use of cutting-edge haemostatic assessment models, such TEG, haemostatic problems in cervical cancer patients may be managed in a tailored and targeted way, improving clinical results and maybe lowering the risk of thromboembolic events.
6. The development of new models emphasises the necessity of adaptability and innovation in healthcare settings with constrained resources, as well as the possibilities for utilising local knowledge and cooperation to overcome obstacles and enhance patient care.

7. Clinicians can employ hemostasiological markers of blood in cervical cancer patients by identifying high-risk patients who can benefit from more aggressive thromboprophylaxis treatments and avoiding unnecessary interventions in low-risk patients, can enhance patient outcomes.
8. Filling in gaps and overcoming these constraints can have significant effects on the precise diagnosis and treatment of haemostatic disorders in cervical cancer patients.

In conclusion, resolving global cervical cancer mortality disparities needs healthcare, cancer prevention, screening, awareness, socioeconomic variables, and creative hemostasiological evaluation models. Better care, thromboprophylaxis, and collaboration can improve cervical cancer outcomes worldwide.

Author contribution

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

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Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

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