

Review

## Evaluating Cardio Neurology Disease in Cancer Patients Requiring Intensive Care Unit Support: A Systematic Review

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**Abstract:** Cerebrovascular disorders refer to all abnormal functions of the central nervous system (CNS) that result from disruption of the normal blood supply to the brain. Stroke is the leading cardiovascular disease both in the United States and worldwide. We reviewed a total of 49 articles published between 2001 and 2024 using keywords (stroke and embolism, cancer, obesity, brain, and heart block) in international databases such as MEDLINE (PubMed and Ovid), Web of Science, and Scopus. The data were analyzed using SPSS software. According to the results, stroke can be divided into two main types: ischemic strokes (85%), which involve vascular occlusion and significant reduction in cerebral perfusion, and hemorrhagic strokes (15%), which involve leakage of blood from vessels into the brain or subarachnoid space. Despite the similarities between these two types, the common causes or their etiology, pathophysiology, treatment, surgical management, and nursing care differ. No significant association was found between obesity, muscle mass index, and stroke. Therefore, efforts to prevent other mentioned risk factors should be intensified.

**Keywords:** neurocardiology, cancer, intensive care unit.

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### Introduction

Acute cardiovascular disease (CVD) has become more common in patients with active cancer as a result of epidemiological and general risk factors. Acute cardiovascular events may be a consequence of both the tumor itself and its treatment. In rare cases, acute coronary syndrome (ACS) may be the first sign of cancer and require additional investigations [1-3].

Management of acute CVD in cancer patients often requires a multidisciplinary, patient-centered approach, taking into account the disease prognosis and the established therapeutic response. Hence, when acute cardiovascular side effects of anticancer therapy occur, the possibility of stopping treatment should be carefully weighed against its continuation [4-6]. In this regard, physicians providing emergency cardiology care should be provided with basic knowledge of acute cardiovascular complications of anticancer therapy, as well as the diagnosis and treatment of acute CVD in cancer patients [7, 8].

Cancer patients hospitalized for various reasons in the intensive care unit (ICU) must have the knowledge and skills required to provide cardiac care for the growing spectrum and

complexity of CVD, whether pathology or comorbidity. This study is the first systematic review to examine CVD in cancer patients requiring treatment in the ICU. Previous studies have examined the most common acute cardiovascular complications associated with cancer treatment, as well as the diagnosis and treatment of ACS and acute pericarditis in cancer patients [2, 9]. Consequently, the goal of this study was to evaluate neurocardiovascular diseases in cancer patients requiring ICU support.

### Methods

The current study analyzed 49 articles published up to 2024 using keywords (stroke and embolism, cancer, obesity, brain and heart block) from international databases such as MEDLINE (PubMed and Ovid), Web of Science and Scopus.

The keywords were standardized in MeSH (Medical Subject Headings) and used for searching: "Neoplasms" [MeSH] OR "Early cancer detection" [MeSH] OR "Oncology institutions" [MeSH] OR "Cancer survivors" [MeSH] OR "Neoplasms/complications" [MeSH] OR "Neoplasms/etiology" [MeSH] OR "Neoplasms/mortality" [MeSH] OR "Neoplasms/prevention and control" [MeSH] OR

"Neoplasms/therapy" [MeSH] AND "Cerebrovascular disorders" [MeSH] OR "Cerebrovascular disorders/complications" [MeSH] OR "Cerebrovascular disorders/therapy" [MeSH] OR "Brain diseases" [MeSH] OR ("Cardiovascular system" [MeSH] OR "Cardiovascular infections" [MeSH] OR "Cardiovascular abnormalities" [MeSH] OR "Diagnostic methods, cardiovascular" [MeSH] OR "Cardiovascular diseases" [MeSH] OR "Cardiovascular risk factors" [MeSH] OR "Metabolic syndrome" [MeSH] OR "Myocardial infarction" [MeSH] OR "Cardiological rehabilitation" [MeSH] OR "Cardiology" [MeSH] AND "Central nervous system" [MeSH].

**Data collection**

The search strategy was as follows: first, a list of titles and abstracts of all articles found in the considered databases was prepared. This work was carried out by two researchers independently of each other. Then, articles with duplicate titles were removed. Then, the abstracts of the articles were checked for relevant studies, all of the identified studies were saved in EndNote X8 and the remaining steps were performed by the software.

**Selection criteria**

Studies reporting on cancer treatment and cardiovascular complications, acute pericarditis in cancer patients, and stroke in cancer patients. Studies other than clinical trials, cohort, descriptive, and observational were excluded from this review.

**Assessing the risk of bias**

The methodological quality of the included cohort studies was assessed using the Newcastle-Ottawa Scale (NOS) [10]. Each study was assigned a maximum of nine stars on this scale. A study was

considered high-quality if it received seven or more stars; otherwise, it was considered low-quality.

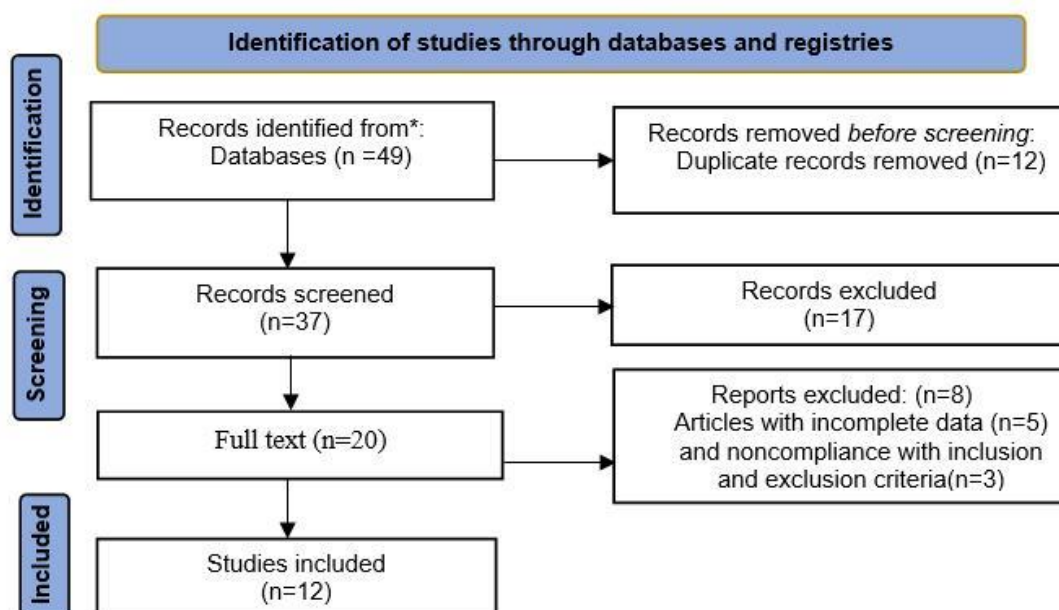
**Data analysis**

Proportions calculated in the meta-analysis.

**Results**

The first search yielded 49 articles, 12 of which were excluded in the first step because they contained duplicate records based on their titles. In the second step, the abstracts of 37 articles were reviewed to screen out 17 studies that did not meet the inclusion criteria. In the third step, the full texts of 20 articles were reviewed and 8 were excluded because they contained some missing information or did not meet the inclusion and exclusion criteria. A total of 12 articles were included in the study ([Figure 1](#) and [Table 1](#)).

**Ischemic strokes.** Ischemic strokes, cerebrovascular accidents (CVAs), or what is known as brain attack, constitute sudden cessation of brain function due to disruption of the blood supply to an area of the brain. The term brain attack is used to help healthcare professionals and the general public understand that the condition is considered a medical emergency, similar to a heart attack [11]. The approval of thrombolytic therapy in 1996 for the treatment of acute ischemic strokes revolutionized the care of stroke patients. Early treatment with thrombolytic drugs, or thrombolytics, makes ischemic strokes less symptomatic and less disabling [12]. Only 8% of ischemic strokes result in death within 30 days. Modern thrombolytic therapy must start within 3 hours of stroke onset [13]. The public and health care professionals should be aware that after a stroke, the patient should be hospitalized for medical evaluation and drug injections [13, 14].



**Figure 1.** PRISMA 2020 flowchart of included subjects.

**Table 1.** Proportion of neurocardiovascular diseases in cancer patients requiring intensive care unit

##	Study	Year	Proportion weight 98%	Weight %
1	Drachman & Skom (21)	1965	0.82 [0.39-1.06]	5.30
2	Dunnigan et al. (22)	1984	0.57 [0.54-1.02]	5.20
3	Lanza et al. (20)	1983	0.58 [0.63-1.01]	5.57
4	Kennedy et al. (16)	1982	0.65 [0.25-1.08]	6.13
			Heterogeneity $t^2=0.02$ , $I^2=0.00$ , $H^2=1.02$	0.55 [0.22-1.07]
Test of $\Theta=\Theta$ , $Q(4)=5.55$ , $P=0.741$				
1	Furlan et al. (23)	1984	0.44 [0.27-1.08]	6.08
2	Colette & Monnier (23)	2007	0.46 [0.52-0.22]	4.82
3	Boyer & Paharia (24)	2008	0.11 [0.54-0.89]	5.85
4	Hinton et al. (25)	1977	0.34 [0.12-0.99]	4.09
			Heterogeneity $t^2=0.14$ , $I^2=0.11$ , $H^2=0.42$	0.47 [0.19-1.00]
Test of $\Theta=\Theta$ , $Q(4)=3.35$ , $P=0.343$				
1	Birman (26)	2023	0.92 [0.39-1.06]	3.03
2	Govier et al. (27)	1984	0.84 [0.54-1.02]	5.33
3	Balsini (28)	2024	0.49 [0.63-1.01]	4.50
4	Edmunds (28)	1982	0.64 [0.25-1.08]	5.03
			Heterogeneity $t^2=0.14$ , $I^2=0.00$ , $H^2=1.02$	0.47 [0.22-1.07]
Test of $\Theta=\Theta$ , $Q(4)=3.55$ , $P=0.122$				

### Risk of embolism in sleeve gastrectomy

Gastric sleeve surgery involves removing a large portion of the stomach, which helps the patient lose weight. After a gastric sleeve, the reduced volume of the stomach makes the person feel full after eating a small amount of food, and in a way, this surgery prevents overeating and excessive food consumption. Please note that this procedure is recommended for people with significant weight loss who have not been able to lose weight through diet and exercise [15]. Therefore, if you are obese, choose nonsurgical options first and body contouring surgery last.

### Is there a risk of embolism after sleeve gastrectomy?

As mentioned, there is a chance of blood clots after most surgeries, including sleeve gastrectomy. Since the body naturally works to prevent bleeding and coagulate it, there is a chance of blood clots with any surgery. Although with the advancement of medical science and the development of equipment in the field of bariatric surgery, the likelihood of this complication has decreased. However, the serious complications of embolism and the mortality caused by it are still debated. As mentioned, factors such as obesity increase the likelihood of blood clots. Therefore, there is a possibility of embolism even before sleeve gastrectomy, but after the surgery, the likelihood of embolism increases as one of the side effects of the surgery. In general, obesity, surgical complications, and a long recovery period that leads to immobility of patients are the main factors causing blood clots and embolism after sleeve gastrectomy [16].

### Cause of embolism after sleeve gastrectomy

Although there is a possibility of postoperative complications such as embolism, some factors increase the risk of embolism after sleeve gastrectomy. Hypoactivity is one of the major reasons increasing the risk of embolism after sleeve gastrectomy. Therefore, as soon as the patient's general condition improves, the doctor recommends starting short walks in the first days, and over time – walking and doing suitable sports [17]. Please note that light walks in the first weeks after sleeve gastrectomy improve blood circulation and prevent blood clots. In addition to

immobility, the risk of embolism after sleeve gastrectomy is significantly higher in patients who smoke than in non-smokers. Therefore, smokers are advised to refrain from smoking at least one month before surgery and one month after it [17].

### Symptoms of embolism after sleeve gastrectomy

In general, embolism can vary depending on the size and location of the clot. For example, pulmonary embolism symptoms lead to serious breathing problems and even death.

### Embolism treatment after sleeve gastrectomy

The first step is to locate the embolus and treat it accordingly by assessing its location and size. One of the most important treatments for embolism after sleeve gastrectomy is anticoagulation and embolectomy. Usually, small clots are removed with anticoagulants, but if a large clot forms, an embolectomy is performed in order to remove the blockage to prevent further damage and serious risks such as the clot moving to the lung [18, 19]. There are many causes and risk factors for blood clots, including chronic diseases such as diabetes and atrial fibrillation, medications such as birth control pills and hormone replacement therapy, lifestyle factors such as smoking and being overweight, and in rare cases, inherited bleeding disorders [20].

### What complications can embolic stroke have?

A stroke can have long-term effects on your health. Whether you develop any complications after a stroke depends on the severity of the stroke and the part of the brain affected.

Some risk factors are beyond control. For example, men are at higher risk of stroke than women, even though women are more likely to die from stroke. People with a family history of stroke or who have had a mild stroke in the past are also at increased risk. A mild stroke is also known as a transient ischemic attack.

### How can embolic stroke be prevented?

Knowing your risk level for stroke can help prevent future strokes, especially if you take other preventive measures. See your doctor regularly if you have high cholesterol, diabetes, or chronic autoimmune diseases. Monitoring your condition and following your doctor's recommendations can help prevent or limit possible complications of a stroke. [Table 1](#) presents the incidence of stroke and embolism based on clinical and radiographic data in cancer patients undergoing bariatric surgery.

### Discussion

It is possible that blood clots can even form in the brain of a developing fetus in the womb. The most serious consequence of blood clots in the brain is a stroke caused by a blood clot, which is called an ischemic (also known as obstructive) stroke, and most strokes are of this type. Most ischemic strokes can lead to the death of the patient if not treated promptly and in a timely manner. If you or someone around you notices any symptoms or complications associated with a blood clot in the central nervous system, it is best to go to the nearest emergency room as soon as possible for proper diagnosis and timely treatment. This will help to avoid unpleasant consequences [29].

According to many experts in the field of health and wellness, physical activity and exercise are very important, effective and

desirable factors in changing your lifestyle and controlling these risk factors. Regular, continuous and long-term physical activity, developed and implemented on the basis of scientific and practical methods under the supervision of specialists in sports and physical education, allows preventing complications associated with hypoactivity and, in addition to reducing and stopping the development of atherosclerosis, controlling and correcting the associated risk factors, such as obesity, weight gain, lipid metabolism disorders, high cholesterol, hypertension and diabetes. Many studies show that physical exercise and physical activity are probably an appropriate stimulus for the correction and reduction of risk factors for CVDs, and there is a relationship between the level of physical activity of men and women of different ages and the reduction, correction and modification of risk factors for CVDs [30, 31].

Metabolic syndrome is a set of risk factors including obesity, hypertension, dyslipidemia and elevated plasma glucose levels. Metabolic syndrome is closely associated with the development of CVDs, insulin resistance and diabetes mellitus. Metabolic syndrome has become a modern epidemic with increasing prevalence. The most important cause of metabolic syndrome is insulin resistance, which initially causes postprandial hyperinsulinemia and then fasting hyperinsulinemia, ultimately leading to hyperglycemia. People with metabolic syndrome are 1.5 to 3 times more likely to develop CVD and 3 to 5 times more likely to develop type 2 diabetes [32].

Insulin resistance is one of the most important risk factors for cardiometabolic diseases, including type 2 diabetes, metabolic syndrome, and cardiovascular disease [18]. Insulin resistance is a key component of the cardiovascular risk factor complex [19]. On the other hand, insulin resistance is a key pathological link between obesity, type 2 diabetes, and metabolic syndrome. Several risk factors, such as obesity, physical inactivity, body fat distribution, age, and hyperinsulinemia, may be markers of insulin resistance. Insulin resistance is a predictor of type 2 diabetes even in people with normal glucose tolerance [33].

The direct and gold standard technique for assessing insulin resistance is the hyperinsulinemic-euglycemic clamp. However, it is invasive, complex, time-consuming and expensive. Therefore, several simple alternative indices have been introduced. They use fasting insulin and/or glucose alone or in combination with insulin and glucose in different samples of the glucose tolerance test, along with the use of other metabolic variables such as triglycerides [34].

Most studies examined and compared the accuracy of one or more of these methods with the hyperinsulinemic-euglycemic clamp [35]. However, their accuracy in diagnosing cardiovascular risk or metabolic syndrome has received less attention. In their study, Silver et al. (1984) showed that hospitals with higher patient satisfaction had lower statistics related to length of stay and patient mortality than other hospitals [36]. In a study on the relationship of patient satisfaction with prompt pain relief and postoperative complications conducted at Mia Teaching Hospital in Florida, USA, by Sundaram et al. (1986), it was established that there was a relationship of patient satisfaction with pain relief and complications: 92% of patients who experienced postoperative pain experienced major postoperative complications, and 91.8% of patients who were satisfied or very satisfied experienced significantly fewer complications [37]. Therefore, postoperative pain control and treatment are statistically significantly effective in

the recovery after surgery, length of patient stay and postoperative satisfaction of patients [38].

In contrast, ineffective pain relief can lead to patient discontent, poor communication of the patient with the physician and nurse, complications, delayed recovery, longer hospital stays, and increased medical costs. For example, changes in physiological parameters such as tachycardia, rapid shallow breathing, and elevated blood pressure are common manifestations of pain. On the other hand, tension in the muscles of the chest, abdomen, and diaphragm, and ultimately the patient's reluctance to breathe deeply to avoid pain, can cause breathing problems and reduce oxygen supply to the myocardium. Unfortunately, despite scientific advances in the pathophysiology and treatment of pain, most patients still complain of excruciating pain. In the United States, patients undergoing surgery report inadequate pain relief, and there is evidence of inadequate pain control by health care providers. In the field of coronary artery bypass grafting, studies also showed that despite the presence of moderate to severe postoperative pain and the possibility of maximum relief in these patients by prescribing analgesics, some physicians and nurses are reluctant to use specific analgesics [39]. Researchers believe that various reasons contribute to inadequate postoperative pain control, including inadequate pain assessment by patients, individual differences in the level of pain perception and expression, inadequate communication between health care professionals and patients, negative attitudes toward drug use, and misperceptions about the concept of pain [40]. The main challenge in achieving the goal of pain relief in patients may be the subjective nature of pain. Since pain is an experience that is subjective to the individual and each person expresses it differently, this makes it difficult to accurately assess pain. In fact, the way and degree to which people respond to the sensation and experience of pain is influenced by factors such as age, gender, birth order, culture, race, past experiences, coping style, social support, and religious beliefs. Therefore, nurses, more than other members of the patient care team, must understand pain and be able to fully assess it, understand the patient's expectations, misconceptions, and ultimately relieve pain. Wolf et al. (1978) also observed higher improvements in endurance and strength with combined exercise vs. endurance and strength training [41].

### Conclusion

The results of this study demonstrated no significant associations between obesity, muscle mass index and stroke. Therefore, more active measures should be taken to prevent other risk factors. Direct oral anticoagulants should be prescribed to patients undergoing cancer treatment, especially in those with an increased risk of blood clots, since the benefit of reducing blood clots seems to outweigh the risk of minor bleeding.

### Conflict of interest

Authors declared no conflicts of interest.

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