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DOI: 10.15225/PNN.2026.15.2.0 JNNN 0000;0(0):0–0 **Case Report**

Specifics of Caring for a Pregnant Woman after Surgical Removal of a Brain Aneurysm — a Case Study

Specyfika opieki nad kobietą ciężarną po operacyjnym zabiegu usunięcia tętniaka mózgu — opis przypadku

Anna Jabłońska[1], **Zuzanna Bordowicz**[2], **Joanna Wach**[3], **Aleksandra Kołtuniuk**[4]

❶ Division of Midwifery Fundamentals, Department of Midwifery, Faculty of Nursing and Midwifery, Wrocław Medical University, Poland

❷ Department of Midwifery, Faculty of Nursing and Midwifery, Wrocław Medical University, Poland

❸ Division of Specialist Care in Midwifery and Gynecology, Department of Midwifery, Faculty of Nursing and Midwifery, Wrocław Medical University, Poland

❹ Department of Anesthesiology and Perioperative Nursing, Department of Nursing, Faculty of Nursing and Midwifery, Wrocław Medical University, Poland

Abstract

Introduction. Arteriovenous malformations (AVMs) are developmental disorders of the intracranial vascular system which may increase in size over time, thereby leading to intracerebral hemorrhage. AVMs may often coexist with intracranial aneurysms.

Aim. The aim of this paper is to present the specifics of caring for a pregnant woman after surgical removal of an arteriovenous malformation and cerebral aneurysm, who underwent right hemispheric osteodural decompression and embolization of the front parietal region. The following research method was employed: an individual case study using the nursing process. The tools used included: interview, observation, analysis of medical records, and literature review.

Case Report. A G1P0 patient at 26 weeks of gestation was admitted to hospital due to sudden onset left-sided numbness and hemiparesis. A CT examination revealed, among other findings, intracerebral hemorrhage; angio-CT showed an arteriovenous malformation adjacent to the hematoma with an accompanying aneurysm. The pregnant patient underwent two complex surgeries (craniectomy and embolization). The total duration of hospitalization from admission to transfer to the labor room was 77 days. Based on the nursing process method, the following nursing problems were identified: risk of pressure ulcer development and impaired self-care resulting from left-sided paresis.

Discussion. The paper discussed the topic of AVMs, intracranial aneurysms, and hemorrhagic strokes. Statistics on the incidence of hemorrhagic strokes during pregnancy, management strategies in pregnant patients, and studies on the frequency of AVM-related strokes are also presented. The identified nursing problems and proposed management strategies are compared with clinical case reports available in Polish and international literature. The study was prepared in accordance with the principles of evidence-based medicine (EBM), enabling the inclusion of current scientific research and best clinical practices.

Conclusions. A pregnant woman who experiences complex clinical situations beyond her control represents a special case. The paper highlights the need for specialized neurological rehabilitation and ongoing cooperation of the interdisciplinary team. **(JNNN 0000;0(0):0–0)**

Key Words: cerebral aneurysm, neurosurgical operation, postoperative care

Streszczenie

Wstęp. Malformacje tętniczo-żylne (AVM) są zaburzeniami rozwojowymi wewnątrzczaszkowego układu naczyniowego, które w miarę upływu czasu mogą powiększać swoje rozmiary, doprowadzając tym samym do krwotoku śródmózgowego. AVM często mogą towarzyszyć tętniaki wewnątrzczaszkowe.
Cel. Praca ma na celu przedstawienie specyfiki opieki nad kobietą ciężarną po operacyjnym zabiegu usunięcia malformacji tętniczo-żylnej i tętniaka mózgu, u której dokonano odbarczenia kostno-twardówkowego prawej półkuli mózgu oraz embolizacji okolicy czołowo-ciemieniowej. Metoda badawcza to analiza indywidualnego przypadku z wykorzystaniem procesu pielęgnowania. Narzędzia wykorzystane w pracy to: wywiad, obserwacja, analiza dokumentacji medycznej oraz kwerenda literatury.
Opis przypadku. Pacjentka ciężarna CI PI w 26. tygodniu ciąży zgłosiła się do szpitala z powodu nagłego drętwienia i niedowładu lewostronnego. W badaniu TK opisano m.in. krwotok śródmózgowy, w angio-TK w sąsiedztwie krwiaka widoczna malformacja tętniczo-żylna, z towarzyszącym tętniakiem. Ciężarna przeszła dwie skomplikowane operacje (kraniektomię oraz embolizację). Łączny czas trwania hospitalizacji od momentu przyjęcia do przekazania na blok porodowy wynosił 77 dni. Opierając się na procesie pielęgnowania, sformułowano problemy pielęgnacyjne m.in.: ryzyko wystąpienia odleżyn oraz trudności w samopielęgnacji będące konsekwencją niedowładu lewostronnego.
Dyskusja. Rozwinięto temat AVM, tętniaków wewnątrzczaszkowych oraz udarów krwotocznych. Przedstawiono statystykę występowania udarów krwotocznych w czasie ciąży, metody leczenia pacjentek ciężarnych oraz badania przedstawiające częstość występowania udarów z powodu AVM. Przedstawione problemy pielęgnacyjne wraz z proponowanymi strategiami ich rozwiązania porównano z opisami przypadków klinicznych dostępnych w literaturze polskiej i zagranicznej. Opracowanie zostało przygotowane zgodnie z założeniami medycyny opartej na dowodach (EBM), co umożliwia uwzględnienie aktualnych wyników badań naukowych oraz najlepszych praktyk klinicznych.
Wnioski. Ciężarna, która z przyczyn od niej niezależnych doświadczyła skomplikowanych sytuacji klinicznych, jest przypadkiem szczególnym. Zwrócono uwagę na potrzebę zapewnienia specjalistycznej rehabilitacji neurologicznej oraz stałej współpracy zespołu interdyscyplinarnego. **(PNN 0000;0(0):0–0)**
Słowa kluczowe: tętniak mózgu, operacja neurochirurgiczna, opieka pooperacyjna

Introduction

Arteriovenous malformations (AVMs) are developmental disorders of the intracranial vascular system. Over time, they may increase in size, thereby leading to intracerebral hemorrhage. Clinical symptoms of AVMs include: epilepsy, focal neurological deficits (dementia, hemiparesis, visual field disturbances), severe headaches, and cranial bruit [1].

Diagnosis of arteriovenous malformations (AVMs) is based on computed tomography (CT) of the head, CT angiogram, magnetic resonance imaging (MRI), MR angiogram, and catheter angiograpm, whereas the diagnosis of intracranial aneurysms is based primarily on head CT and CT angiogram. In pregnant patients requiring urgent neuroradiological examinations, the procedure is performed with fetal shielding. Contrast agents (GBCA) used in MRI, which should not be administered to pregnant women, may be considered if absolutely necessary [2,3].

According to statistical data, the incidence of intracranial aneurysm rupture during pregnancy is only 1–10 per 100,000 pregnancies, occurring — in most cases — prior to delivery (92%), most commonly in the third trimester (80%). Mortality is estimated at 3–7% [4].

There are many causes of intracerebral hemorrhage: arterial hypertension, cerebral amyloid angiopathy, neoplasm, coagulation disorders, including vascular malformation and aneurysm. Conservative treatment relies on the administration of prothrombin concentrate and vitamin K. In the event of deterioration of the patient's condition, e.g., decreased Glasgow Coma Scale (GCS) score, surgery is required [1].

The selection of treatment methods for intracranial aneurysms and arteriovenous malformations depends on their extent and localization. One of the surgical methods for treating AVMs associated with ruptured aneurysm is craniotomy, which involves creating one or more burr holes widened with a craniotome [5].

The purpose of this paper is to present and analyze the specifics of caring for a pregnant woman who underwent surgical removal of a cerebral aneurysm with right hemispheric osteodural decompression and embolization of the front parietal region. The study presents the nursing problems experienced by the patient during prolonged hospitalization. Since the neurosurgical procedure was performed for neurological reasons, the study highlights the necessity for an individualized approach to this neurosurgical patient, including standard obstetric care. The intention of the study is to emphasize the multifaceted character of the approach to the problems of the patient in this particular clinical situation. A key study objective is to underscore the need for multidisciplinary support provided by a team comprising a nurse, midwife, perinatologist, obstetrician, neurologist, neurosurgeon, and other specialists.

Case Report

A.P., a 28-years-old G1P0patient was admitted to one of the hospitals in Wrocław at 26 weeks of gestation due to sudden onset numbness and subsequent weakness of the left limbs. The interview revealed that — until then — the pregnancy had progressed without complications. Family history was unremarkable, with no previous incidents.

The CT performed on admission revealed: "increasing volume of intracerebral hematoma in the right hemisphere, measuring approximately 3.3×6.4×4.6 cm, and displacement of midline structures to the left by approximately 5 cm. The hemorrhage originates from a vascular malformation (most likely arteriovenous) visible in CT angiography near the convexity of the right cerebral hemisphere, adjacent to the falx cerebri (Figure 1)".

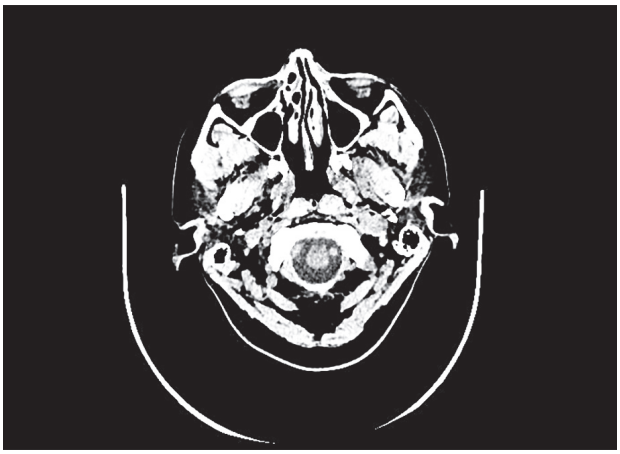


Figure 1. CT scan of the patient's head on admission

The patient was evaluated by a neurologist and neurosurgeon, who recommended conservative management. No obstetric abnormalities were identified.

On admission to the ICU the patient was conscious, responsive and conversing, oriented to person and place, followed commands and answered questions. Speech was slightly slurred, mildly dysarthric. Meningeal signs negative, pupils 4/4 equal and reactive, slight facial asymmetry to the left, left-sided paralysis, preserved superficial sensation, no pyramidal signs. Cardiovascular and respiratory systems was assessed as efficient; HR 88/min, BP 126/74 mmHg, SpO_2 98%. Symmetrical vesicular breath sounds. Abdomen was not tender, distended; the patient reported fetal movements; peristalsis was present. Urine output was preserved.

In the evening neurological deterioration occurred — decrease in GCS score from 15 to 11 (1/4/6). CT showed an increase of the hematoma in the right frontal lobe (to 3.8×6.8×5.1 cm), significant edema of the right hemisphere, further midline shift to the left by approx. 1.4 cm (previously 0.8 cm).

The patient was not qualified for emergent neurosurgical treatment.

The following morning, further deterioration was observed. GCS was assessed at 8 points (1/4/6). The patient was unable to communicate. She was qualified for emergency surgical procedure and transferred to the operating room. Neurological examination revealed dilated pupils with weak reaction to light. Cardiovascularly stable, afebrile, with hourly monitored diuresis. Due to lack of contact, a follow-up CT was performed, which revealed intracerebral hematoma in the right frontal and parietal lobes measuring 4.0×6.4×4.8 cm, surrounded by edema, with significant mass effect and midline shift to the left by approx. 1.4 cm, intense swelling of the right hemisphere, and compression of sulci and gyri of the left hemisphere, particularly at the convexity (Figure 2).

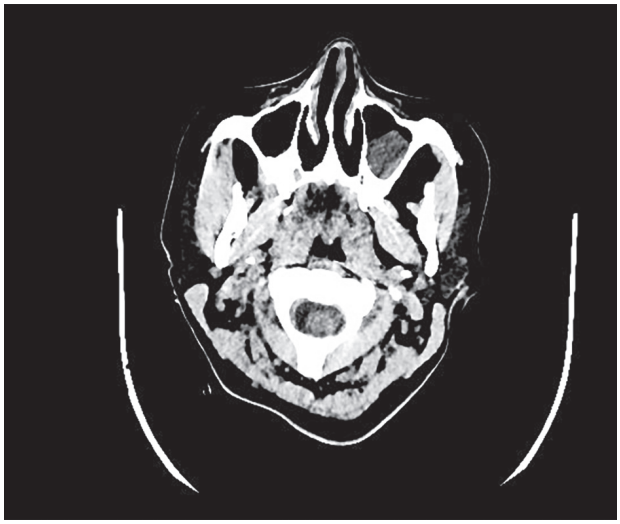


Figure 2. CT scan on day two of hospitalization

A central venous catheter was inserted into the left internal jugular vein, and a nasogastric tube was placed. CTG showed a regular fetal heart rate of approx. 130 bpm, moderate variability, reactive tracing. At 11:00 a.m. the patient was transferred to the operating room.

The patient underwent craniectomy with evacuation of the aneurysm and clipping of the bleeding vessel. Postoperative CT proved of limited diagnostic capability due to artifacts. The malformation in the right frontal lobe remained visible but significantly smaller: now measuring approx. 2.5 mm. The aneurysm had decreased in size. The patient presented postoperative status after right frontoparietal craniotomy with hemostatic material and drain left in place.

Post-operative Day 0

The patient was transferred to the Intensive Care Unit (ICU). General condition upon admission: HR 76 bpm, BP 120/80 mmHg, SpO_2 94%. She was sedated

with 2% Propofol and Sufentanil (SFNT). Pupils equal, weakly reactive. Hemodynamically unstable, supported with an infusion of Levonor 4 mg/50 ml. Respiratory insufficiency requiring mechanical ventilation via an endotracheal tube; a moderate amount of mucous-bloody secretion was suctioned from the bronchial tree. Mucous secretion with small amounts of blood clots was suctioned from the oral cavity. After confirming the correct position of the nasogastric tube, enteral feeding was initiated. The urinary catheter was patent; diuresis monitored hourly. Head dressing clean, without visible hyperemia. During nursing activities, the patient was able to squeeze hands upon command and could feel touch in all extremities, although markedly weaker on the left side. Skin clean, without pressure injuries. CTG tracing showed regular fetal heart rate at approximately 135 bpm, with moderate variability and a reactive pattern. No uterine contractions were observed.

Post-operative Day 1

The patient remained continuously connected to monitoring equipment. General condition: HR 65 bpm, BP 115/55 mmHg, SpO_2 94%. The patient was unconscious, under analgosedationwith an infusion of 2% Propofol and Sufentanil 250 mg/50 ml. Respiratory insufficiency requiring mechanical ventilation via endotracheal tube; a moderate amount of mucopurulent secretion was aspirated from the bronchial tree. She was receiving enteral nutrition via a gastric tube, with additional water administered. The urinary catheter was patent; diuresis monitored hourly. The head dressing was changed in accordance with aseptic and antiseptic principles. The surgical drain remained in place. Cerebral oximetry monitoring was continued. Bone decompression was moderately tense, with visible swelling on the right side. Pressure-ulcer prophylaxis was implemented. Full body hygiene was performed. The skin was clean and free of pressure ulcers. On CTG tracing, the fetal heart rate was regular at approximately 130 bpm, with moderate variability and a reactive pattern. No uterine contractions were observed.

Post-operative Day 2

General condition parameters: HR 66 bpm, BP 110/50 mmHg, SpO_2 95%. The pregnant patient was unconscious, under analgosedation with an infusion of 2% Propofol and Sufentanil. Pupils equal, narrow, sluggish, but reactive. Hemodynamically stable. Respiratory insufficiency persisted; the patient remained intubated and mechanically ventilated. A moderate amount of purulent secretion was suctioned from the bronchial tree. She received enteral feeding via gastric tube, with supplemental water administration. Diuresis was supported with Mannitol boluses. Dressing over the postoperative wound was clean and dry. Bone-dural decompression soft, tense. Facial edema present, most pronounced on the right side. Neurosurgical consultation was performed, and the drain was removed. Cerebral oximetry monitoring continued. Skin intact, with ongoing pressure-ulcer prophylaxis throughout the shift. Due to elevated body temperature, light covering was used. CTG tracing showed regular fetal heart rate at approximately 140 bpm, with moderate variability and a reactive pattern. No uterine contractions were observed.

Post-operative Day 3

General condition parameters: HR 66 bpm, BP 140/75 mmHg, SpO_2 95%. The patient was sedated with 2% Propofol. Pupils equal with sluggish light reaction. Hemodynamically stable; due to elevated arterial blood pressure, a Trandate infusion was initiated. Respiratory insufficiency persisted, requiring mechanical ventilation via endotracheal tube. A moderate amount of purulent secretion was suctioned from the bronchial tree as well as aspirated from the oral cavity. The patient was fed enterally and given supplemental parenteral water. Diuresis supported with Mannitol boluses. Dressing over the postoperative wound remained clean, dry, unchanged. Bone-dural decompression site was soft, tense. Skin without visible pressure ulcers. Patient care performed according to hospital procedures. CTG tracing showed regular fetal heart rate at approximately 138 bpm, moderate variability, reactive pattern. No uterine contractions were observed.

Post-operative Day 7

Seven days after surgery, following gynecological and radiological consultations, the patient underwent embolization of the right fronto-parietal region. In the following days, she received further neurosurgical and gynecological consultations, and a follow-up head CT scan was performed. The scan demonstrated significant regression of the hyperdense hematoma in the right cerebral hemisphere. No additional signs of intracranial bleeding were observed. Regression of white-matter changes surrounding the hematoma was noted. The ventricular system was symmetrical and not dilated (Figure 3).

Conservative, anti-edema, and antihypertensive treatments, along with antibiotic prophylaxis, were continued. After discontinuation of sedatives, the patient was disconnected from the ventilator and extubated.

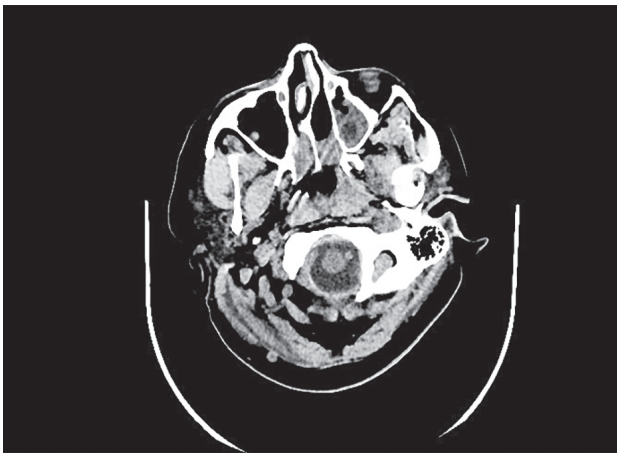


Figure 3. Patient's head CT scan 7 days after the procedure

On post-operative day 12, the patient was transferred to the Pregnancy Pathology Unit in good general condition: HR 80 bpm, BP 123/76 mmHg, SpO_2 96%. The patient was conscious, oriented to person and place, calm, and logically conversing. Pupils symmetrical (4/4 mm). The site of bone-dural decompression was bulging, soft. Persistent left-sided hemiparesis. Hemodynamically and respiratorily stable. Obstetric condition normal. CTG tracing showed regular fetal heart rate at approximately 147 bpm, moderate variability, reactive pattern. No uterine contractions were recorded.

During hospitalization at the Pregnancy Pathology Unit, the patient was under continuous supervision of obstetrician-gynecologists. Her general condition and obstetric condition was monitored daily. Examinations were performed according to the Individual Medical Orders Chart. Due to left-sided hemiparesis, she required full assistance with activities of daily living.

Nursing Diagnoses and Evaluation of Interventions

Problem 1. Limited Mobility and Impaired Ability to Perform Self-care Activities due to Left-sided Hemiparesis

Purpose of nursing care: To minimize difficulties in self-care and mobility in a patient with left-sided hemiparesis.
Nursing interventions:

1. Assistance with full-body hygiene.
2. Assistance with changing clothes and bed linens.
3. Assistance with changing body position.
4. Support during daily self-care activities.
5. Ensuring patient comfort and safety.
6. Providing privacy and respect for personal dignity during care activities.
7. Motivating the patient to perform self care activities.

Justification of the actions taken: Maintaining proper personal hygiene is critical for preventing skin infections and pressure ulcers. Regular changing of clothing and bedding supports cleanliness, reduces microbial colonization, and prevents skin infections. Frequent repositioning prevents pressure ulcers, improves peripheral circulation, and facilitates breathing, thereby minimizing complications associated with immobilization. Support in daily activities enhances patient safety, independence, and psychological comfort while allowing assessment of functional capacity [6].
Assessment: Difficulties with self-care were minimized. Conditions ensuring privacy and safety were provided.

Problem 2. Increased Risk of Imbalance and Falls Related to the Physiological Shift of the Body's Center of Gravity during Pregnancy and the Presence of Hemiparesis

Purpose of nursing care: Minimize fall risk and enhance safety during prolonged hospitalization.
Nursing interventions:

1. Securing the patient with side rails, bolsters, and pillows to prevent falling out of bed.
2. Providing the pregnant patient with assistive devices such as a walker to improve safety and mobility.
3. Regular physiotherapy/rehabilitation tailored to the patient's needs and capabilities.
4. Ensuring safety during position change, assisting the patient during movement.
5. Educating the patient about physiological changes occurring in the body during pregnancy.

Justification of the actions taken: Pregnant patients undergoing prolonged hospitalization require an environment properly equipped to support mobility. During early attempts at upright standing and mobilization, it is essential to monitor patient's skin coloration, pain response, and vital signs. To prevent contractures and muscle atrophy, the physiotherapist may perform passive exercises of paralyzed limbs [7]. Passive exercises are performed when the patient cannot move independently and should include full-range movement across all planes [8]. Activation of the affected side is essential for patient's fitness. Pregnancy shifts the center of gravity forward, which leads to a change in posture and may cause back pain, especially in the lumbar region. This shift also increases the risk of imbalance, which can lead to a swaying gait and other balance problems. Proper education on this topic and assistance are paramount for patient's safety, which is a fundamental element of nursing care. Ensuring safe conditions for movement reduces the risk of injuries and falls, while

caring for physical and mental comfort has a positive effect on the recovery process [9].
Assessment: The patient's room was adapted to her current needs. She was informed to call staff using the emergency bell should her condition worsen. Daily essential items were kept within reach. The patient acquired knowledge of and support for minimizing the risk of falls. She is aware of her limitations related to her physiological condition of pregnancy as well as those associated with left-sided hemiparesis.

Problem 3. Risk of Pressure Ulcers due to Impaired Mobility

Purpose of nursing care: Prevent the formation of pressure ulcers resulting from impaired mobility.
Nursing interventions:

1. Monitoring humidity, temperature, and air circulation in the patient's room.
2. Keeping the skin clean and dry.
3. Off-loading pressure using an anti-decubitus mattress.

Justification of the actions taken: Pressure ulcers are pressure-induced injuries resulting from physiological disturbances in the body and caused by external, negative(varied) factors. They have always represented both a medical and social issue due to their high prevalence and associated treatment costs. It is estimated that pressure ulcers occur in 14–41% of hospitalized patients and in 17–28% of those receiving home care. Undoubtedly, pressure ulcers are a source of pain and significantly reduce the patient's quality of life. They are more common in elderly individuals and in those who are immobile for prolonged periods [10,11].
Assessment: No pressure ulcers developed during hospitalization. All nursing interventions were effective and prevented the formation of injuries.

Problem 4. Risk of Postoperative Wound Infection Following Craniectomy

Purpose of nursing care: Prevent infection of the postoperative wound.
Nursing interventions:

1. Visual inspection of the wound.
2. Maintaining wound cleanliness.
3. Avoiding unnecessary pressure on the wound.
4. Teaching the patient simple eyelid exercises.

Justification of the actions taken: Visual assessment includes observation for swelling, redness, warmth, and discharge. Wounds must be kept clean and irrigated with Microdacyn. Avoiding pressure with unnecessary dressing prevents impaired healing. Postoperative eyelid edema and incomplete closure may occur after the procedure; therefore eye hygiene, lubricating ointments, drops, and artificial tears are recommended [12].
Assessment: No postoperative wound infection occurred. The wound was regularly inspected and cleaned according to aseptic and antiseptic principles.

Problem 5: Discomfort Caused by Chronic Cough Resulting from Prolonged Intubation

Purpose of nursing care: Reduce discomfort associated with persistent cough.
Nursing interventions:

1. Use of mucosa moisturizers and room humidification.
2. Improving comfort during coughing by elevating the head of the bed and gentle chest percussion.
3. Ensuring appropriate microclimate in the patient's room.
4. Avoiding irritants and prolonged speaking that may cause coughing.
5. Adjusting physical activity of the patient to her current condition and fitness level.

Justification of the actions taken: The patient was extubated upon admission, without signs of active respiratory infection but with persistent cough impairing daily functioning. Moisturizing medications and an appropriate room environment were applied. Nursing interventions included elevating the patient's head (by 30–45°) and gentle percussion of the back [13]. Light percussion soothes the nervous system, reduces muscle tension, and facilitates expectoration [14,15].
Assessment: Elevated head positioning, gentle percussion, and proper room conditions gradually reduced symptoms and improved patient comfort.

Problem 6. Maternal Anxiety Regarding Fetal Health in the Context of Diagnosed Fetal Growth Restriction (FGR)

Purpose of nursing care: Reduce maternal anxiety regarding the well-being of the fetus.
Nursing interventions:

1. Monitoring fetal status through physician-ordered ultrasound and CTG.
2. Encouraging the patient to talk to with midwives and physicians to address concerns and questions.

Justification of the actions taken: Fetal Growth Restriction is a condition in which the fetus fails to achieve its expected growth potential. Ultrasound accurately assesses fetal well-being through EFW, AFI, MCA PI, UA PI, and fetal heart rate. CTG allows continuous monitoring of fetal heart function and uterine contractions, enabling

early recognition of life-threatening conditions, including hypoxia. A reactive CTG tracing with accelerations and moderate variability is expected [16,17].
Assessment: The patient became calmer; her status was explained clearly. She understood that a multidisciplinary team was engaged in fetal care.

Discussion

Arteriovenous malformations (AVMs) are congenital abnormalities involving direct artery-vein connections, resulting in high-flow shunting. These lesions are prone to rupture [1,18,19]. AVMs account for 2–4% of hemorrhagic strokes. Aneurysms associated with AVMs increase rupture risk and are present in 18% of AVM cases, raising annual hemorrhage risk from 1.7% (isolated AVM) to approximately 7% when an aneurysm is present. Treatment of aneurysms with AVMs requires a multidisciplinary approach, often involving additional supplementary treatments. Spetzler-Martin grading scale guides treatment selection. Low-grade AVMs (SM 1–2) offer the possibility of immediate cure. In contrast, higher-grade lesions require staged embolization and/or radiosurgery. Patients with AVMs undergo microsurgical procedures aimed at removing the malformation, and in cases with an associated aneurysm, clipping of the bleeding vessel is performed [3]. At admission, CT angiography revealed a progressing hematoma progression and the presence of an AVM. Clinical deterioration evidenced by a drop in GCS score (from 11 to 8) necessitated craniectomy to grant an invasive access to the lesion. The accompanying aneurysm required surgical clipping. Management of hemorrhage caused by an AVM during pregnancy is complex and encompasses multiple available treatment modalities, as well as considerations arising from the ongoing pregnancy. Current AHSC guidelines recommend preconception consultations with vascular neurology and neurosurgery teams for patients with known vascular malformations [20].

To date, uniform guidelines have not been developed for the management of patients with previously unknown vascular malformations that first present during pregnancy. A team led by Yan K-L. reviewed the University of California, San Francisco database (within the Brain AVM Project) of pregnant patients who experienced hemorrhage caused by a cerebral arteriovenous malformation between 2000 and 2017. Sixteen patients were identified: nine in the second trimester (14–28 weeks' gestation) and four in the third trimester (29–42 weeks' gestation) — who experienced hemorrhage. Three patients in the first trimester (0–13 weeks' gestation) chose to terminate the pregnancy (two patients) and one patient miscarried. The most common symptoms accompanying the hemorrhage were headache and focal neurological deficits (ataxia and aphasia). Five patients underwent immediate microsurgical resection, four underwent embolization followed by microsurgical resection, and one patient underwent microsurgical resection before delivery and radiosurgery after delivery to treat residual AVM. In three patients the treatment was deferred. Following delivery, whether vaginal or by cesarean section, no neonatal complications were reported [20].

In the present case study, particular attention was given to the difficulties in self-care and personal hygiene resulting from the onset of left-sided hemiparesis. The nursing interventions undertaken are consistent with the measures proposed by other authors [6,21], who highlight the necessity of supporting the patient in personal hygiene, meal consumption, and dressing, as well as point to the need for implementing rehabilitative exercises. The described case is quite unique, because in addition to the typical nursing issues associated with stroke, care must also focus on a specific type of patient — a pregnant woman. The risk of falling during pregnancy may induce fear of movement, which worsens mobility and physical condition. Effective prophylaxis focused on education and support during movement reduces the risk of injury, improves patient comfort and quality of life, and enhances fetal safety. The proposed interventions are consistent with the most recent available scientific evidence (EBM) and clinical experience [22,23].

Another nursing problem arising from the patient's clinical condition concerned the risk of pressure ulcer development. Pressure ulcers are undoubtedly a source of pain and significantly reduce a patient's quality of life; therefore, it is crucial to identify risk factors from the very first moments of hospitalization. Studies have shown that pressure ulcers most commonly appear within the first two weeks of immobilization. To facilitate the assessment of pressure-ulcer risk, medical staff use scoring tools such as the Norton, Braden, Waterlow, and Douglas scales. The risk of pressure ulcers may concern any patient; however, it is greater in individuals with limited mobility and in those hospitalized in intensive care units, regardless of age. Preventive measures include tissue off-loading using specialized mattresses, appropriate nutrition, skin care, and properly selected physical exercises. It is important to remember to rehabilitate patients who are immobilized for prolonged periods, as lack of movement promotes not only pressure-ulcer formation but also deep vein thrombosis, pneumonia, circulatory failure, and depression. A pregnant woman who remained in the ICU and who developed left-sided hemiparesis is at high risk of pressure-ulcer formation. It was therefore necessary to implement daily, regular rehabilitation, maintain skin integrity, ensure appropriate room temperature, provide a well-balanced diet, and minimize infection risk [11,24].

Considering the presented data, the case report, and the patient's diverse nursing problems, it may be concluded that pregnancy accompanied by unplanned and complex clinical situations affecting both the patient and the fetus is undoubtedly an additional source of stress.

Conclusions

1. A pregnant woman diagnosed with an arteriovenous malformation accompanied by an aneurysm and hemorrhagic stroke is a unique and high-risk case.
2. Postoperative AVM patients require holistic, multidisciplinary care involving a neurologist, obstetrician-gynecologist, midwife, nurse, psychologist, and physiotherapist.
3. Care must prioritize self-care challenges, mobility limitations, and prevention of wound infection and pressure ulcers.
4. Frequent monitoring of fetal well-being is essential in pregnant patients with AVM.

References

[1] Lindsay K.W., Bone I., Fuller G. *Neurologia i Neurochirurgia*. Wyd. Edra Urban & Partner, Wrocław 2022.

[2] Greenberg S.M. Malformacje naczyniowe. W: Greenberg S.M. (Red.), *Neurochirurgia*. Tom 2. Wyd. Lekarskie PZWL, Warszawa 2023;1815–1826.

[3] El-Abtah M.E., Petitt J.C., Kashkoush A., Achey R., Bain M.D., Moore N.Z. Endovascular Management of Arteriovenous Malformation-Associated Intracranial Aneurysms: A Systematic Literature Review. *World Neurosurg*. 2022;164:257–269.

[4] Thornburg L.L., Birsner M.L. Inne choroby neurologiczne u kobiet w ciąży. W: Berghella V. (Red.), *Perinatologia według zasad EBM*. Wyd. MP, Kraków 2023;257–270.

[5] Graczyk D., Melka D., Jaracz K. Diagnoza pielęgniarska i plan opieki nad chorym z urazem czaszkowo-mózgowym. W: Jaracz K., Domitrz I. (Red.), *Pielęgniarstwo neurologiczne*. Wyd. Lekarskie PZWL, Warszawa 2019;548–556.

[6] Bajor K., Andrzejczyk P. Opieka pielęgniarska nad pacjentem po przebytym udarze niedokrwiennym mózgu — studium przypadku. *Wsp Piel Ochr Zdr*. 2019;8(2):72–77.

[7] Bartoń E. Opieka nad chorym po operacji tętniaka śródczaszkowego. W: Bartoń E. *Pielęgniarstwo neurochirurgiczne*. Wyd. Lekarskie PZWL, Warszawa 2024;696–706.

[8] Lankau A. Ćwiczenia czynne, bierne. W: Klimaszewska K., Baranowska A., Krajewska-Kułak E. (Red.), *Podstawowe czynności medyczne i pielęgnacyjne*. Wyd. Lekarskie PZWL, Warszawa 2017;75–80.

[9] Bryndal A., Glowinski S., Majchrzycki M. Influence of Pregnancy on the Occurrence of Lumbar Spine Pain in Polish Women: A Retrospective Study. *J Pers Med*. 2022;12(3):357.

[10] Kózka M. Częstość występowania odleżyn i koszty leczenia. W: Bazaliński D., Kózka M. (Red.), *Odleżyny w praktyce klinicznej. Zapobieganie i leczenie*. Wyd. Lekarskie PZWL, Warszawa 2021;3–10.

[11] Przybek-Mita J.Z., Sałacińska I., Fąfara A. i wsp. Profilaktyka odleżyn. W: Bazaliński D., Kózka M. (Red.), *Odleżyny w praktyce klinicznej. Zapobieganie i leczenie*. Wyd. Lekarskie PZWL, Warszawa 2021:57–94.

[12] Bartoń E. Opieka nad chorym po kraniotomii czołowej i usunięciu guza mózgu. W: Bartoń E. *Pielęgniarstwo neurochirurgiczne*. Wyd. Lekarskie PZWL, Warszawa 2024;715–716.

[13] Wójkowska-Mach J. Podstawy kontroli zakażeń w warunkach zakładu opieki zdrowotnej. W: Bulanda M., Wójkowska-Mach J. (Red.), *Zakażenia szpitalne w jednostkach opieki zdrowotnej*. Wyd. Lekarskie PZWL, Warszawa 2016;87–93.

[14] Jarocka I.T., Kulikowska A. Toaleta drzewa oskrzelowego. W: Klimaszewska K., Baranowska A., Krajewska-Kułak E. (Red.), *Podstawowe czynności medyczne i pielęgnacyjne*. Wyd. Lekarskie PZWL, Warszawa 2017;532–552.

[15] Lankau A. Technika masażu klasycznego W: Klimaszewska K., Baranowska A., Krajewska-Kułak E. (Red.), *Podstawowe czynności medyczne i pielęgnacyjne*. Wyd. Lekarskie PZWL, Warszawa 2017;65–74.

[16] Kwiatkowski S., Torbe A., Borowski D. i wsp. Rekomendacje Polskiego Towarzystwa Ginekologów i Położników w zakresie diagnostyki i postępowania w ciążach powikłanych ograniczeniem wzrastania płodu. *Ginekol Perinatol Prakt*. 2020;5(3):119–130.

[17] Brawura-Biskupski-Samaha R., Kosińska-Kaczyńska K. *Fizjologiczna interpretacja KTG w teorii i przykładach*. Medical Tribune, Warszawa 2024.

[18] Sanders B.D., Davis M.G., Holley S.L., Phillippi J.C. Pregnancy-Associated Stroke. *J Midwifery Womens Health*. 2018;63(1):23–32.

[19] Zhu D., Zhao P., Lv N. et al. Rupture Risk of Cerebral Arteriovenous Malformations During Pregnancy and Puerperium: A Single-Center Experience and Pooled Data Analysis. *World Neurosurg*. 2018;111:e308–e315.

[20] Yan K.L., Ko N.U., Hetts S.W. et al. Maternal and Fetal Outcomes in Women with Brain Arteriovenous Malformation Rupture during Pregnancy. *Cerebrovasc Dis*. 2021;50(3):296–302.

[21] Kołtuniuk A., Staworowska M., Rosińczuk J. Proces pielęgnowania pacjenta po przebytym udarze krwotocznym. *Wsp Piel Ochr Zdr*. 2016;5(3):88–93.

[22] Miller E.C. Maternal Stroke Associated with Pregnancy. *Continuum (Minneap Minn)*. 2022;28(1):93–121.

[23] Opaskar A., Massaquoi R., Sila C. Stroke in pregnancy. *Handb Clin Neurol*. 2021;177:283–293.

[24] Szewczyk M.T., Kózka M., Cierzniakowska K. i wsp. Profilaktyka odleżyn — zalecenia Polskiego Towarzystwa Leczenia Ran. Część I. *Leczenie Ran*. 2020;17(3):113–146.

Corresponding Author:

Anna Jabłońska

Division of Midwifery Fundamentals,
Department of Midwifery,
Faculty of Nursing and Midwifery,
Wrocław Medical University
Bartla 5 street, 51-618 Wrocław, Poland
e-mail: anna.jablonska@umw.edu.pl

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Author Contributions: Anna Jabłońska[A, C, E, F], Zuzanna Bordowicz[A–C, F], Joanna Wach[E, F], Aleksandra Kołtuniuk[G, H]

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