The Effect of Colloid Therapy (Gelatin) in Maintaining Hemodynamic Stability in Patients at Risk of Intraoperative Hypovolemic Shock in the Central Surgical Installation (IBS): Case Study

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Abstract

Aims: This case study investigated the effects of colloid therapy (gelatin) on maintaining hemodynamic stability in patients at risk of intraoperative hypovolemic shock during total hysterectomy and bilateral salpingo-oophorectomy.

Methods: A descriptive case study with a single case design was conducted on patient Mrs. S during the intraoperative phase, observing hemodynamics before and after colloid therapy (gelatin) administration.

Results*:* During the intraoperative phase, in the first 40 min, there was a decrease in blood pressure to 92/52 mmHg, an increased heart rate of 117 beats/minutes, and an MAP of 65. Subsequently, blood pressure improved during the administration of colloid fluid therapy, with the patient's blood pressure reaching 113/72 mmHg, heart rate 84 beats per minute, and MAP 85 after 40 minutes. After 60 minutes of colloid fluid therapy, blood pressure was 110/62 mmHg, heart rate was 73 beats per minute, and MAP was 77.

Conclusion: Collaborative intervention with colloid therapy effectively restored and maintained the hemodynamic stability of patients at risk of hypovolemic shock during the intraoperative phase.

Keywords: colloid therapy, hemodynamics, hypovolemic shock

Introduction

Ovarian Cancer Stage II B Treatment (Ovarian Cancer) is primarily managed with surgery. Management typically includes total hysterectomy and bilateral salpingo-oophorectomy, as the cancer has spread beyond the ovaries (Kurniawan, 2019). Hysterectomy is usually performed with bilateral salpingo-oophorectomy as a single procedure (Cusimano et al., 2021). Surgical procedures can lead to complications, such as hypovolemic shock (Nur et al. 2023). Hypovolemic shock remains the leading cause of death in countries with high levels of population mobility. Approximately 9% of trauma-related deaths in the United States are caused by shock due to uncontrolled bleeding (World Health Organization, 2015). Meanwhile, 6.9% of total deaths worldwide occur in Europe (Hady et al. 2022). Traumatic injuries are the most common cause of hemorrhagic shock. The national prevalence of injuries is 8.2%, with the highest prevalence in South Sulawesi (12.8%) (Kemenkes RI, 2013).

Hypovolemic shock typically presents with clinical symptoms, such as lowered vital signs, hypotension, tachycardia, reduced urine output, and decreased consciousness (Fachrurrazi et al., 2022). The management of hypovolemic shock includes restoration of vital signs and hemodynamic stability to normal limits. Subsequently, this condition remains stable (Andriati and Trisutrisno, 2021). The interventions that can be provided include hemodynamic monitoring and collaboration for fluid therapy. Nursing interventions for hypovolemic shock with collaborative fluid therapy aim to replace lost body fluid or blood. The fluid therapy used in this case was colloid. Colloid fluids or plasma expanders have been used as plasma substitutes. Colloid fluids used for hypovolemic shock management include crystalloids, colloids, and Packed Red Cells (PRC). Gelatin (Gelafusal) is a commonly used colloid for treating and preventing hypovolemic shock (Afriani, 2022). Gelatin colloids were chosen because they last longer in the intravascular space, which is expected to provide better tissue oxygenation, thereby maintaining more stable hemodynamics (Nasriyah, 2021). The volume effect lasts approximately 2-3 hours and does not interfere with blood coagulation mechanisms, making this a key factor in its selection (Pranata, 2017). In this case study, the researcher demonstrated the effect of colloid therapy (gelatin) on maintaining hemodynamic stability in patients with intraoperative hypovolemic shock.

Case History

Patient Mrs. S, 39 years old and weighing 42 kg, was diagnosed with a cystic ovarian neoplasm. Surgical staging was then performed. After surgical staging, the patient was diagnosed with stage IIB ovarian cancer. The patient had a history of abdominal enlargement for the past two months, and she reported abdominal pain, especially when pressed. Physical examination of the abdomen revealed a palpable tumor mass measuring approximately 10 cm × 10 cm. Supporting examination results Ultrasound (USG) of the urological system revealed bilateral adnexal masses. Chest X-ray findings: suspected nodular lesion in the left lung (pulmonary sinistra), right hilar lymphadenopathy, and aortic elongation.

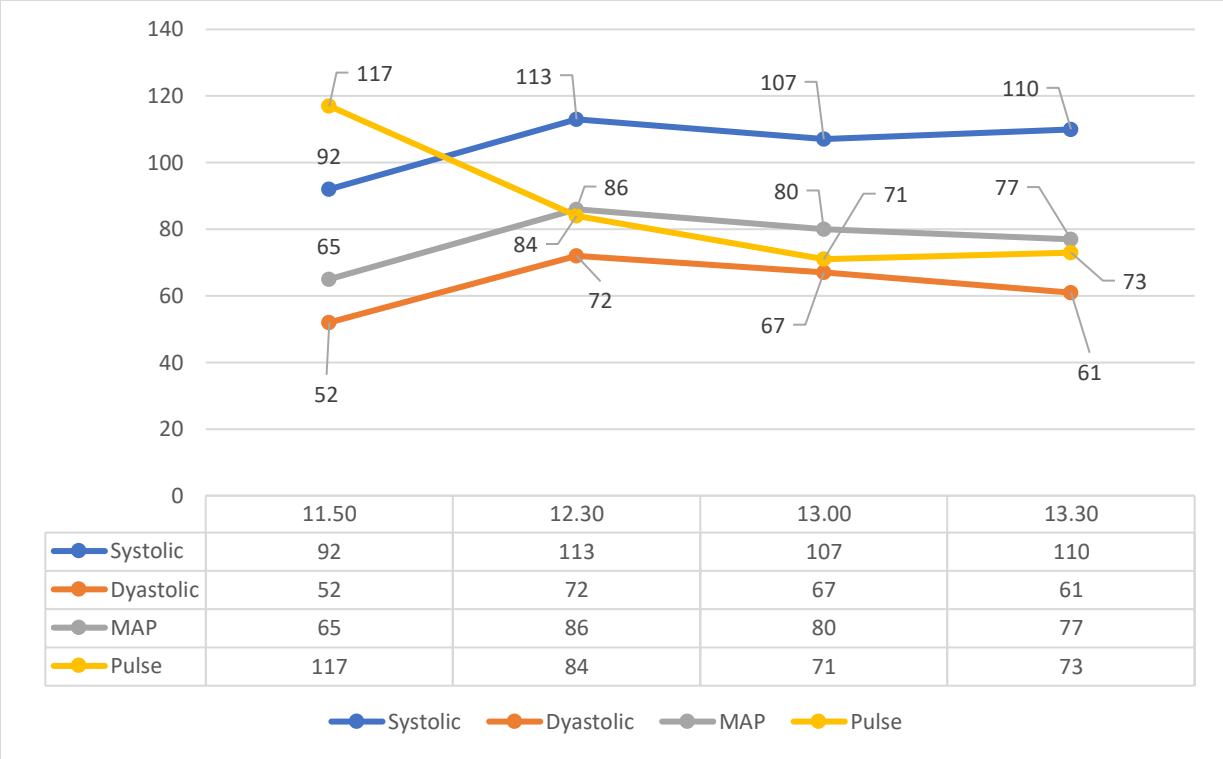
Table.1 Laboratory results on December 12, 2024 (within normal limits).

Test	Result
Hemoglobin	13.0 g/dl
Platelets	340.000 /uL
Leukocytes	11.020 /uL
Hematocrit	38.9 %
Erythrocytes	4.710.000 /uL
MCV	82.6 fl
MCH	27.6 pg
MCHC	33.4 g/dl
Neutrophils	75.9 %
Absolute Neutrophils	8.360 /uL
Lymphocytes	16.4 %
Monocytes	5.4 %
Eosinophils	1.9 %
Basophils	0.4 %
PT	14.9 INR
aPTT	32.7 seconds
GPT	15 U/L
GDS	104 mg/dL
HBsAg	Non-reactive

The surgical procedure was performed on December 16, 2024, when surgical staging was followed by total hysterectomy and bilateral salpingo-oophorectomy. The surgery lasted for 2 hours and 21 minutes. The patient was placed in a supine position under spinal anesthesia. Monitors were set up to assess systolic blood pressure, diastolic blood pressure, Mean Arterial Pressure (MAP), heart rate, and oxygen saturation to monitor the patient's hemodynamics. The patient was administered crystalloid fluid (Ringer's lactate) during the surgery.

Administration of Colloid Therapy (Gelatin)

Following the administration of anesthesia, the patient experienced hemodynamic changes. The observed hemodynamic changes included a decrease in blood pressure from 112/88 mmHg to 92/52 mmHg, accompanied by an increase in heart rate from 78 beats/min to 117 beats/min. The mean arterial pressure (MAP) dropped from 95 to 65. Respiratory rate, body temperature, and oxygen saturation remained within normal limits. In addition, the capillary refill time was >3 s. The condition of the patient's skin could not be assessed because of full-body sterile draping. The total blood loss was recorded at 900 cc. Based on the collected data, the patients were categorized as having compensated shock (Class II). Observations revealed a drop in blood pressure within 40 minutes during the intraoperative period, indicating early signs of hypovolemic shock that required immediate intervention. Pharmacological therapy was administered, specifically 500 cc of colloid solution (gelatin) over a 30-minute infusion period, as an initial response to stabilize the patient's hemodynamic status.



Graphic 1. *Intraoperative Hemodynamic Profile*

Follow-up

The hemodynamic status of the patient improved (Graphic 1). In the first 30 minutes, the following changes were observed: blood pressure increased to 113/72 mmHg, MAP increased to 86, and heart rate increased to 84 beats per minute. In the second 30 minutes, blood pressure was 107/67 mmHg, MAP was 80 beats per minute, and heart rate was 80 beats per minute. In the third 30 minutes, the blood pressure was 110/61 mmHg, MAP was 77 beats per minute, and heart rate was 73 beats per minute. The monitoring results (Table 1) indicated a continuous improvement in both blood pressure and heart rate over the last 30 minutes. Hemodynamic status was assessed by observing the attached monitor using a Mindray ePM 10 monitor.

The patient was then transferred to the post-anesthesia care unit (PACU) at 13:46. Upon arrival at the PACU, the following vital signs were recorded: blood pressure, 110/86 mmHg; heart rate 115; body temperature, 35.2°C; respiratory rate, 18 breaths/minutes; and oxygen saturation, 98%. The mean Bromage score was 1. The patient was then transferred to the general ward at 15:02 WITA, as the overall condition was stable and fully conscious. One drain was placed and the patient was administered 500 mL of Ringer's lactate solution. On the first postoperative day, laboratory tests were performed, with the following results: leukocytes: 18,380 /µL, erythrocytes: 4,160,000 /µL, hemoglobin: 11.6 g/dL, hematocrit: 33.8%, MCV: 81.3 fL, MCH: 27.9 pg, MCHC: 34.4 g/dL, platelets: 306,000 /µL, absolute Neutrophils: 17,320 /µL, neutrophils: 94.2%, lymphocytes: 3.7%, monocytes: 2.0%, eosinophils: 0.0%, basophils: 0.1%, immature Granulocytes: 0.2% *(Impression: Leukocytosis).* No unexpected events or complications occurred during and after the administration of colloid therapy.

Discussion

Nurses play a crucial role in collaborating with physicians to manage hypovolemic shock in surgical patients. In the case of Mrs. S, a decrease in blood pressure and tachycardia were observed, which are indicative of hypovolemic shock caused by active blood loss. These symptoms represent the compensatory mechanisms of the body in response to ongoing hemorrhage (Fachrurrazi et al., 2022). Prompt and appropriate shock management is essential for preventing morbidity and mortality during surgery (Retnaningsih et al. 2024). Massive blood loss can lead to hemodynamic instability, particularly when bleeding occurs in the thoracic, abdominal, or retroperitoneal cavity (Hooper & Armstrong, 2022). Therefore, in surgical cases in which signs of hypovolemic shock, such as changes in hemodynamic parameters, are present, immediate intervention is necessary to prevent adverse outcomes.

The hypovolemic shock experienced by the patient was categorized as compensatory shock in stage II. Literature reviews indicate that hypovolemic shock caused by hemorrhage typically presents with signs and symptoms such as hypotension and increased heart rate (Hady et al., 2022). A previous case study also reported that patients with hypovolemic shock experienced decreased blood pressure and increased heart rate (Siore & Sise, 2022). Once the signs and symptoms of hypotension and tachycardia were identified, shock management interventions were initiated, specifically general shock therapy through collaborative administration of colloid fluids in the form of gelatin. The use of colloidal fluids in shock management is considered a second-line treatment for hemorrhage.

After hemodynamic changes were identified, shock management was initiated through general shock therapy, involving the collaborative administration of colloid fluids in the form of gelatin, with the goal of hypovolemic shock management optimizing hemodynamic stability, which included maintaining a mean arterial pressure (MAP) of 60–85 mmHg and maintaining systolic and diastolic blood pressure within normal limits, both of which are indicators of adequate tissue perfusion (Saputra et al., 2021). Colloid solutions offer more effective volume expansion than crystalloids, particularly in their ability to increase the circulating volume (Luh et al., 2014). This is because of their larger molecular weight and osmotic activity, which allows the fluid to remain longer in the intravascular space, with a half-life of approximately 3–6 h (Sari et al., 2021). The selection of fluids administered during surgery must be tailored to a patient's specific clinical needs.

Gelafusine (500 mL) was used as colloid fluid. Research has shown that gelatin polysuccinate can increase oncotic pressure, thereby preventing shock caused by severe blood loss (Eckelt et al., 2022). Gelatin solutions are widely used as colloid plasma substitutes for the treatment of hypovolemia (Moeller et al., 2016). During the intervention, the patient's hemodynamic status was continuously evaluated. The primary assessment of hemodynamic status is generally performed by monitoring the heart rate (HR) and mean arterial pressure (MAP), which serve as surrogate markers of tissue perfusion (Kurniawaty et al., 2019). Therefore, it is essential to continuously monitor changes in the patient's hemodynamic parameters to determine whether improvement has occurred.

During the administration of colloid fluids (gelatin), a gradual increase in blood pressure and a decrease in heart rate were observed. Consequently, the patient's vital signs

returned to a stable condition. Other studies have also shown that gelatin therapy is effective in improving and stabilizing hemodynamics when administered via infusion for less than 15 min (Pascoe & Lynch, 2017). The administration of gelatin-type colloid fluids can increase venous return, thereby sufficiently enhancing cardiac output to maintain venous return to the heart and sustain intraoperative hemodynamic stability (Sari, 2024). This is attributed to the fact that Gelatin solutions remain longer in the intravascular space, which is expected to provide better tissue oxygenation and more stable hemodynamic parameters (Nasriyah, 2021). Based on observations conducted during gelatin administration, the patient's hemodynamics improved and returned to normal conditions.

Nursing interventions involving hemodynamic monitoring were continuously performed until the completion of the surgery. The evaluation results following the administration of colloid fluids showed that the patient's vital signs remained stable until the end of the procedure. This indicates that the management of shock risk related to the patient's nursing problems was successfully addressed, as evidenced by the fulfillment of adequate tissue perfusion. Healthcare professionals play an essential role in managing hypovolemic shock to maintain patient stability throughout the surgical procedure. This is also supported by other studies, which state that the roles of scrub, circulating, and anesthesia nurses are crucial in maintaining patient stability during surgery (Retnaningsih et al., 2024). Nurses play a vital role in all surgical procedures, including the preoperative, intraoperative, and postoperative phases (Edy & Hidayah, 2023). In an operating room team composed of various healthcare professionals with different roles and responsibilities, all members work toward a common goal (Qiftia & Wilkado, 2021).

Limitations

This case report has certain limitations, primarily the involvement of a single patient, which may limit the generalizability of the findings to larger or different populations. Additionally, the short observation period, which is limited to a single point in time, restricts the ability to evaluate the long-term effects. Therefore, further studies involving a larger number of patients and more robust research designs are necessary to validate the findings of this case report and explore their applicability in broader clinical practice. However, the strength of this case report lies in its ability to provide insights into the clinical changes resulting from fluid management, particularly the patient’s hemodynamic response. Moreover, this may serve as a foundation for generating new ideas and hypotheses for future research.

Contribution to Global Nursing Practice

This study makes an important contribution to global nursing practice by highlighting the effectiveness of colloid therapy (gelatin) in maintaining hemodynamic stability in patients at risk of intraoperative hypovolemic shock. These findings strengthen the role of nurses in continuously monitoring the hemodynamic status and making prompt decisions regarding appropriate fluid therapy during surgical procedures. By offering evidence-based practices that can be applied across different countries and healthcare systems, this study supports the development of standardized care protocols in surgical settings. The results also encourage the enhancement of nurses' competencies in managing critical conditions, ultimately improving patient safety and quality of nursing care globally.

Conclusion

Intraoperatively, patients are highly vulnerable to hypovolemic shock. Nurses play a crucial role in collaborating with doctors to manage hypovolemic shock in patients undergoing surgery. Collaborative intervention of administering colloid therapy is effective in restoring and maintaining the hemodynamic stability of patients at risk of intraoperative hypovolemic shock.

Author Contributions

All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Conflict of Interest

The authors declare that they have no conflict of interest.

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