Clinical and Experimental Obstetrics & Gynecology

Clin. Exp. Obstet. Gynecol. **2026**; 53(1): 45746
https://doi.org/10.31083/CEOG45746

Original Research

Nursing Care for Severe Ovarian Hyperstimulation Syndrome Complicated With Isolated Pleural Effusion Undergoing Thoracentesis and Drainage

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Academic Editor: Michael H. Dahan
Submitted: 13 August 2025 Revised: 15 September 2025 Accepted: 30 September 2025 Published: 21 January 2026

Abstract

Background: Ovarian Hyperstimulation Syndrome (OHSS) is a severe complication of assisted reproductive therapy. Patients with severe OHSS are complicated with pleuroperitoneal effusion, while isolated pleural effusion is clinically rare. Previous studies have shown that isolated unilateral pleural effusion caused by OHSS mostly involves the right side. Among the 14 patients with severe OHSS complicated with isolated pleural effusion admitted to our hospital from April 2020 to December 2024, the proportion of right-sided effusion was 85.71%, which was consistent with the literature reports. All patients recovered and were discharged after multidisciplinary diagnosis, treatment and nursing care. This study aimed to summarize the nursing experience and provide a reference for clinical practice. **Methods**: A retrospective analysis was conducted on the nursing methods for 14 patients with severe OHSS complicated by isolated pleural effusion (IPE) who underwent puncture and drainage between April 2020 and December 2024. **Results**: All 14 patients completed thoracentesis and drainage, their symptoms were controlled, and each patient quickly navigated the critical period. **Conclusions**: Dynamic patient monitoring of the condition, standardized preoperative preparation, full-cycle catheter management, individualized psychological care, and multi-dimensional thrombosis prevention represent the main nursing measures for patients with severe OHSS complicated by IPE undergoing thoracentesis and drainage.

Keywords: assisted reproductive technology; health education; isolated pleural effusion; nursing care; ovarian hyperstimulation syndrome; thoracentesis and drainage

1. Introduction

Ovarian hyperstimulation syndrome (OHSS) is a serious complication of assisted reproductive technology, with an incidence of approximately 30%. It is characterized by ovarian enlargement, increased vascular permeability, third-space fluid accumulation, and associated pathophysiological processes [1]. The incidence of severe OHSS is reported to be around 0.1%–2% [2]. Approximately 10% of patients with severe OHSS develop pleural and peritoneal effusions, although reports of isolated pleural effusion (IPE) are relatively rare. IPE refers to a clinical phenomenon characterized by the accumulation of fluid in the thoracic cavity without obvious predisposing factors such as significant primary lung disease, malignant tumor, and heart, liver or kidney failure. In the field of obstetrics and gynecology, IPE is mostly associated with OHSS and pregnancy-related complications. IPE complicated by OHSS poses serious clinical challenges due to its insidious onset and high misdiagnosis rate [3]. According to literature reports [4], the vast majority of cases with unilateral IPE caused by OHSS involve the right side. This may be related to the passage of ascites into the right pleural cavity through the diaphragm due to the pressure gradient difference of the thoracic duct.

The present study describes 14 patients with severe OHSS complicated by IPE who were admitted to the Reproductive Medicine Center of our hospital between April 2020 and December 2024. All patients were discharged after recovery following multidisciplinary treatment and nursing care involving the Departments of Reproductive Medicine, Internal Medicine (where doctors performed thoracentesis), Ultrasonography, and Nutrition. The nursing experience for this patient cohort is described below.

2. Materials and Methods

This study is retrospective. Patients with severe OHSS complicated by IPE (n = 14) treated at the Reproductive Center of Women's Hospital, School of Medicine, Zhejiang University from April 2020 to December 2024 were enrolled in this study.

Inclusion criteria: ① Patients who received assisted reproductive technology treatment; ② Patients who met the diagnostic criteria for OHSS and IPE; ③ Chest ultrasound indicating unilateral or bilateral pleural effusion (effusion depth $\geq$5 cm).

Exclusion criteria: ① Pleural effusion of unknown cause; ② Patients with a history of organic cardiopulmonary disease, congenital cardiopulmonary disease, tuberculosis, or malignant tumor.

The mean age of this cohort was 30.00 ± 3.51 years (range: 25.00–38.00, 95% CI: 28.29–31.93), the mean body mass index (BMI) was 22.80 ± 3.27 kg/m^2 (range: 17.58–32.00 kg/m^2, 95% CI: 21.28–24.69), and the mean duration of infertility was 2 (interquartile range, IQR: 1.75, 3.25) years (range: 0.40–8.00 years, 95% CI: 1.88–3.96). Twelve patients had primary infertility and two had secondary infertility. Ovulation induction protocols comprised the Gonadotropin-Releasing Hormone Agonists (GnRHa) long protocol in 9 cases, and the antagonist protocol in 5 cases. The number of retrieved oocytes ranged from 7 to 28. Ten patients underwent fresh embryo transfer, and four underwent all-embryo cryopreservation. Upon admission, all 14 patients presented with varying degrees of chest tightness and abdominal distension, they were treated with hydroxyethyl starch, compound dextran, and thoracentesis and drainage.

3. Results

Thoracentesis and drainage were performed under ultrasound guidance, with 12 patients undergoing right-sided thoracentesis and two undergoing bilateral thoracentesis, corresponding to a right-sided pleural effusion prevalence of 85.71%. The volume of pleural effusion ranged from 510 to 4910 mL, with an average of 2215 mL. The pleural fluid appeared straw-colored in 11 cases and serosanguinous in 3 cases, the latter of which had each undergone all-embryo cryopreservation. One patient with a BMI of $<$18.5 kg/m^2 had a drainage volume of 4910 mL, 9 patients with a BMI in the range of 18.5–23.9 kg/m^2 had a drainage volume of 1823 ± 822 mL (range: 510–3050 mL, 95% CI: 1280–2303), and 4 patients with a BMI $\geq$24 kg/m^2 had a drainage volume of 2422 ± 1434 mL (range: 610–3820 mL, 95% CI: 1277–3685). The indications for thoracentesis drainage [5] in this study were: lateral decubitus ultrasound showing a maximum effusion depth $\geq$5 cm, or sitting position chest radiograph showing an effusion occupying one-third of the thoracic cavity below the costophrenic angle, accompanied by dyspnea (respiratory rate $>$20 breaths/min) or chest tightness (oxygen saturation $<$95% at rest). A unified protocol of percutaneous thoracic catheter placement for continuous pleural drainage was adopted in this study, with the maximum single drainage volume not exceeding 700 mL [6]. The mean length of hospital stay for the 14 patients was 10.43 ± 2.65 days (range: 6.00–16.00 days, 95% CI: 9.21–11.79). Among the 10 patients who received embryo transfer, all successfully delivered at 31–40 weeks of gestation, with favorable maternal and neonatal outcomes. Of these, 5 had twin pregnancies and 5 had singleton pregnancies. The mean length of hospital stay for the 5 patients with singleton pregnancy was 10.40 ± 2.07 days (range: 9.00–14.00 days, 95% CI: 9.20–12.20), and for the 5 patients with twin pregnancy it was 11.40 ± 3.43 days (range: 8.00–16.00 days, 95% CI: 8.80–14.00). The clinical data are shown in Table 1.

4. Discussion

4.1 Condition Monitoring

Vital signs were closely monitored, along with the presence of chest tightness, dyspnea, cough, abdominal pain, and the degree of abdominal distension. For patients with dyspnea, the semi-recumbent position was adopted to facilitate diaphragmatic descent, increase lung capacity, reduce pulmonary compression from ascites and pleural effusion, and relieve respiratory distress [7]. Accurate documentation was made of 24-h fluid intake and output, abdominal girth, and body weight. Abdominal girth measurements were performed at fixed times, locations, and positions to minimize error. Body weight was measured in the morning, after voiding and before eating. Intravenous fluid administration was prescribed based on clinical orders, ensuring proper fluid resuscitation and sequence—crystalloids followed by colloids. Laboratory parameters and pleural effusion were monitored dynamically through serial ultrasound assessments.

4.2 Nursing Care for Thoracentesis and Drainage

4.2.1 Pre-Procedural Preparation

Environmental Preparation: A quiet, clean, and well-lit room with a comfortable temperature was maintained. Curtains were drawn to ensure privacy and minimize patient exposure.

Equipment Preparation: Ultrasound machine (model: GE LOGIQ E20; catalog number: Not applicable; manufacturer: GE Healthcare Trading Development (Shanghai) Co., Ltd.; location: Shanghai, China); sterile kit (catalog number: Zhejiang NMPA Approval 20212140086; manufacturer: Zhejiang Kanglidi Medical Supplies Co., Ltd.; location: Hangzhou, Zhejiang, China), which includes fenestrated drapes, gauze, cotton balls, and needle holder (all components are of the same brand and sterilized by ethylene oxide); No. 4 suture thread (catalog number: S4006010; manufacturer: Hangzhou Aipu Medical Devices Co., Ltd.; location: Hangzhou, Zhejiang, China); suture needle (catalog number: Zhejiang NMPA Approval 20192020440; model: sterile SW-4; manufacturer: Ningbo Medical Suture Needle Co., Ltd.; location: Ningbo, Zhejiang Province, China); lidocaine (catalog number: F220924B; manufacturer: Shandong Qidu Pharmaceutical Co., Ltd.; location: Zibo, Shandong Province, China); 5 mL and 2 mL syringes (catalog number: National NMPA Approval 20193141951; manufacturer: Zhejiang Longde Pharmaceutical Co., Ltd.; location: Hangzhou, Zhejiang, China); Arrow central venous catheter (model: CS-24301-E; catalog number: CS-24301-E; lot number: 71F21G0685; manufacturer: Arrow International Inc.; location: Zdar Nad Sazavou, Czech Republic; specific address: Jamska 2359/47, 59101); non-antimicrobial central venous catheter (catalog number: 220315B; manufacturer: Weihai Jierui Medical Products Co., Ltd.; location: Weihai, Shandong,

Table 1. Clinical data of 14 patients with severe OHSS complicated by IPE.

Group	Age (years)	BMI (kg/m^2)	Duration of infertility (years)	Type of infertility	Ovarian stimulation protocol	No. of retrieved oocytes	No. of transferred embryos	Onset time	Chief complaint on admission	Pleural effusion (Left/Right, cm)	Thoracic drainage site	Drainage volume (mL)	Pregnancy outcome (gestational age at delivery, mode of delivery)
Transfer group	34	23.05	5.5	Primary infertility	Antagonist protocol	7	2	8 days after fresh embryo transfer	Chest tightness, dyspnea, abdominal distension, occasional nausea, vomiting, diarrhea	4.50/9.80	Right side	1990	Singleton live birth (40 w + 1, vaginal delivery)
	29	17.58	1.0	Primary infertility	GnRHa long protocol	12	2	9 days after fresh embryo transfer	Abdominal distension, chest tightness	7.40/15.10	Right side	4910	Twin live birth (34 w, cesarean section)
	29	20.78	3.0	Primary infertility	GnRHa long protocol	12	1	>3 months after fresh embryo transfer	Abdominal distension, chest tightness	Right side 5.80	Right side	510	Singleton live birth (38 w, cesarean section)
	28	25	2.0	Primary infertility	GnRHa long protocol	16	2	16 days after fresh embryo transfer	Chest tightness	7.90/10.30	Right side	3820	Singleton live birth (38 w, cesarean section)
	30	24.03	4.0	Secondary infertility	GnRHa long protocol	9	2	12 days after fresh embryo transfer	Abdominal distension, lower abdominal dull pain	6.20/12.40	Right side	3280	Singleton live birth (38 w + 6, cesarean section)
	27	20.63	2.0	Primary infertility	GnRHa long protocol	11	2	9 days after fresh embryo transfer	Abdominal distension, chest tightness	8.40/7.90	Right side	990	Twin live birth (34 w + 2, cesarean section)
	33	20.20	0.4	Secondary infertility	GnRHa long protocol	11	2	13 days after fresh embryo transfer	Abdominal distension, chest tightness	10.70/7.80	Bilateral	Left 950/Right 920	Twin live birth (32 w + 4, cesarean section)
	38	21.78	3.0	Primary infertility	GnRHa long protocol	8	2	16 days after fresh embryo transfer	Abdominal distension, lower abdominal pain	8.80/13.50	Right side	1130	Twin live birth (35 w + 4, cesarean section)
	29	32	8.0	Primary infertility	Antagonist protocol	19	2	9 days after fresh embryo transfer	Chest tightness, dyspnea, abdominal distension, nausea	8.70/8.70	Right side	1980	Singleton live birth (37 w + 4, vaginal delivery)
	32	22.48	3.0	Primary infertility	Antagonist protocol	13	2	10 days after fresh embryo transfer	Abdominal distension, chest tightness, vomiting	10.70/9.60	Right side	1840	Twin live birth (31 w, vaginal delivery)
All-Embryo cryopreservation group	31	21.48	2.0	Primary infertility	Antagonist protocol	29	/	3 days after oocyte retrieval	Abdominal distension, chest tightness, cough	14.30/8.80	Bilateral	Left 855/Right 1580	/
	30	22.51	2.0	Primary infertility	Antagonist protocol	24	/	Half day after oocyte retrieval	Chest tightness, abdominal distension	9.40/14.00	Right side	2600	/
	25	24.22	2.0	Primary infertility	GnRHa long protocol	23	/	4 days after oocyte retrieval	Chest tightness, dyspnea	7.70/12.20	Right side	610	/
	25	23.50	1.0	Primary infertility	GnRHa long protocol	24	/	5 days after oocyte retrieval	Abdominal distension, chest tightness, dyspnea	9.90/10.60	Right side	3050	/

OHSS, ovarian hyperstimulation syndrome; GnRHa, Gonadotropin-Releasing Hormone Agonists; w, week; IPE, isolated pleural effusion; BMI, body mass index.

China); drainage bag (catalog number: Zhejiang-Taiwan NMPA Filing 20150014; manufacturer: Zhejiang Lingyang Medical Devices Co., Ltd.; location: Linhai, Zhejiang, China); antiseptic swabs (catalog number: Zhejiang-Hangzhou NMPA Filing 20200056; manufacturer: Hangzhou Hualang Medical Technology Co., Ltd.; location: Hangzhou, Zhejiang, China); sterile gloves (catalog number: Jiangxi NMPA Approval 20192140090; manufacturer: Jiangxi Yunge Rubber & Plastic Co., Ltd.; location: Shangrao, Jiangxi, China); and surgical cap (catalog number: Hubei NMPA Approval 20162142405; manufacturer: Winner Medical (Huanggang) Co., Ltd.; location: Huanggang, Hubei, China).

Assessment and Patient Education: The patient's general condition was evaluated, with inquiries about symptoms such as dizziness or worsening chest tightness. The skin was inspected at the intended puncture site for any lesions, infections, or other abnormalities. Thorough explanations were provided to the patient and their family regarding the principles, steps, and safety profile of the procedure. Patient concerns were addressed to alleviate fear and anxiety, thereby facilitating patient cooperation and smooth implementation of thoracentesis and drainage.

Patient Positioning: The patient was positioned in a seated posture, facing the back of a chair. Both forearms rested on the back of the chair, with the forehead resting on the arms, maintaining relaxed, spontaneous breathing.

4.2.2 Cooperation During Thoracentesis

Procedural Cooperation: The physician performed puncture site localization under bedside ultrasound guidance and after selecting the most prominent area of pleural effusion on the affected side as the puncture point, most commonly the 7th–8th intercostal space along the posterior axillary line. The puncture site was precisely located at the superior border of the lower rib within the intercostal space. Prior to the procedure, the puncture area was disinfected in a standardized concentric-circle manner using povidone-iodine, with a disinfection radius of no less than 15 cm. A sterile drape was then applied to establish a surgical field. Local anesthesia was administered with 2% lidocaine. Vertical insertion was performed using a central venous catheter puncture needle, with a distinct sensation of break through indicating entry into the pleural cavity. Upon confirming smooth drainage of pleural fluid, a guidewire was gently advanced through the needle for approximately 20 cm, after which the needle was withdrawn. A central venous catheter was then inserted over the guidewire to a depth of 13–15 cm, and the guidewire removed. The distal end of the catheter was firmly connected to the hub of a 2 mL syringe, which was connected to the drainage bag. After catheter placement, the puncture site was sutured for fixation, followed by coverage with a sterile dressing.

Clinical Monitoring: Throughout the thoracentesis procedure, the patient's vital signs—including heart rate, blood pressure, respiratory rate, and oxygen saturation—were closely monitored. If any abnormalities such as sudden hypotension or tachypnea occured, the physician immediately ordered suspension of the procedure. If necessary, low-flow continuous oxygen was administered.

4.2.3 Post-Thoracentesis Nursing Care

Drainage Management: The frequency of pleural fluid drainage was adjusted according to the rate of pleural effusion production and the patient's clinical symptoms. Prior to each drainage session, information on the patient's vital signs were obtained, including heart rate, blood pressure, respiratory rate, and oxygen saturation, as well as any changes in symptoms such as chest tightness and dyspnea. Vital signs were closely monitored during drainage. If abnormalities such as hypotension or tachycardia occurred, the procedure was immediately suspended and appropriate interventions implemented. Drainage speed was strictly controlled, and the volume from a single-session, unilateral drainage did not exceed 700 mL. If necessary, drainage was repeated at 2-h intervals, with the total daily unilateral drainage volume not exceeding 1000 mL. This precaution was aimed at preventing sudden drops in intrathoracic pressure, pulmonary vasodilation, increased fluid exudation, and the occurrence of acute pulmonary edema. Continuous daily drainage may be performed until no further effusion is drained while the catheter remains patent [8]. Patient complaints were carefully listened to, and if symptoms such as stabbing chest pain, subclavian discomfort, or poor drainage were reported to the physician, adjustment of catheter depth was considered. In the present cohort, four patients experienced pain beneath the costal margin or in the thoracic cavity during drainage. The Visual Analogue Scale (VAS) score was 3.50 ± 0.58 (range: 3.00–4.00, 95% CI: 3.00–4.00). Symptoms resolved in three patients after temporarily suspending drainage and clamping the catheter. In the remaining patient, symptoms persisted after clamping, but resolved following the adjustment of catheter depth. One patient developed stabbing thoracic pain during catheter clamping, which was alleviated after a change in body position.

Catheter Maintenance: The catheter was kept tightly connected to the drainage system. When replacing the drainage bag, the stopcock was clamped to prevent air entry that could lead to pneumothorax. After the completion of drainage, a heparin cap was used to seal the catheter and maintain its airtightness. The risk of catheter blockage is elevated due to the high protein content and viscosity of pleural effusion. The patency of the catheter was assessed during each nursing shift, along with observations of drainage fluid color, consistency, and flow rate. If poor drainage was noted, pulse irrigation of the catheter with normal saline was employed. The puncture site was inspected each shift for signs of redness, induration, or exudation, and sterile dressings changed regularly to reduce the risk of infection

[9]. The depth of catheter fixation was recorded to prevent displacement or accidental removal.

Prevention of Complications: Following catheterization, patients were guided to perform effective pulmonary expansion breathing—inhale through the nose and exhale through pursed lips—to reduce the risk of atelectasis. Regular monitoring was performed of laboratory parameters and pleural ultrasonography. If clinical symptoms improved and ultrasound findings indicated no significant or only minimal pleural effusion, the catheter was removed promptly to minimize infection risk. Catheter retention in this cohort ranged from 2 to 8 days, with an average duration of 4.2 days.

4.2.4 Psychological Care

Patients with severe OHSS complicated by pleural effusion often experience rapid disease progression, accompanied by significant negative emotions such as fear and anxiety. This is particularly evident among those undergoing fresh embryo transfer, who tend to be more concerned about the potential adverse effects of OHSS medications on the fetus [10]. Ten patients in our cohort had undergone embryo transfer. In light of this, a strong nurse–patient relationship must be established to enable psychological support through verbal communication, facial expressions, attitude, and behavior. It is essential to explain in detail the pathogenesis and characteristics of OHSS, provide timely treatment-related information, alleviate the patient's concerns, and help them build confidence in overcoming the disease. Effective communication with the patient's family is also crucial to gain their support and cooperation.

4.2.5 Thrombosis Prevention

Patients with severe OHSS are at increased risk of life-threatening thromboembolic events. Hemoconcentration, reduced plasma volume, and high estrogen levels may contribute to an elevated incidence of thromboembolic disorders. In this case series, all 14 hospitalized patients received heparin for thromboprophylaxis. In addition, patients were instructed to wear compression stockings and perform ankle pump exercises. The patient's condition was closely monitored, as clinical manifestations of thrombosis may include oliguria, anuria, hematuria and proteinuria, as well as headache, seizures, cyanosis, chest pain, dyspnea, and coma.

4.3 Discharge Instructions

The progression of OHSS is positively correlated with the level of human chorionic gonadotropin (HCG) in the body. An increased level of endogenous HCG during pregnancy may exacerbate the condition. Ten of the patients in the present cohort underwent embryo transfer. Patients were instructed to self-monitor after discharge and to seek timely medical attention if they experienced symptoms such as abdominal pain, bloating, or oliguria. None of the 14 patients required readmission due to OHSS, and all 10 patients who underwent embryo transfer delivered successfully.

5. Conclusions

Severe OHSS is a serious iatrogenic complication that may occur during assisted reproductive technology procedures. When complicated by IPE, it can result in a series of compressive symptoms such as dyspnea and chest pain, posing a serious threat to the patient's life and health. It is essential to monitor the patient's condition closely, collaborate effectively with physicians to perform thoracentesis and drainage, emphasize the management of pleural effusions and the prevention of complications, and provide timely psychological care in order to achieve favorable treatment outcomes. This study adopts a single-center retrospective design, with its core limitation lying in the research model itself, which involves the retrospective collection of patient case information. In addition, due to the limitations of single-center case sources, as well as the scarcity of cases and homogeneous screening, there may be selection bias and random errors in the study results, which cannot fully cover OHSS patients from different centers with different baseline characteristics. In the future, we will adopt a multi-center collaboration model to break through the bottleneck of sample size for rare diseases, ensuring that the research conclusions have greater clinical reference value. Furthermore, the initial research design of this study focused on "analysis of the correlation between thoracentesis drainage measures and respiratory function improvement". Therefore, we did not systematically record and present "dynamic monitoring" indicators such as abdominal circumference, urine output, and albumin levels. When conducting similar studies in the future, the quantitative standards for various monitoring indicators and data recording specifications should be provided to ensure the completeness and reproducibility of research details.

Abbreviations

OHSS, ovarian hyperstimulation syndrome; IPE, isolated pleural effusion; BMI, body mass index; GnRHa, Gonadotropin-Releasing Hormone Agonists; HCG, human chorionic gonadotropin; VAS, visual analogue scale.

Availability of Data and Materials

All data points generated or analyzed during this study are included in this article and there are no further underlying data necessary to reproduce the results.

Author Contributions

FZ and JC contributed to data collection, data management, and data analysis. FZ was responsible for conceptualization and revising the draft. FY contributed to the acquisition of literature, participated in the analysis and interpretation of key research data included in the review. LY

made substantial contributions to the conception and design of the review, led the systematic collation and synthesis of literature data, and took primary responsibility for communication with the journal during submission, peer review, and publication processes. Ensured compliance with all journal requirements (including ethics, data availability, and conflict of interest declarations). All authors contributed to critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was carried out in accordance with the guidelines of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Zhejiang University (IRB-20230151-R) in 2023. This study is eligible for waiver of informed consent as approved by the ethics committee.

Acknowledgment

The authors are grateful to the patients for their participation in this study.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

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