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REVIEW

Management of moderate and severe ovarian hyperstimulation syndrome: a Canadian Fertility and Andrology Society clinical practice guideline

BIOGRAPHY

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KEY MESSAGE

Despite improvements in ART, moderate and severe ovarian hyperstimulation syndrome (OHSS) can still occur. Management is primarily supportive as either an outpatient or an inpatient and may include paracentesis. Critical OHSS needs hospitalization and multidisciplinary care.

ABSTRACT

Ovarian hyperstimulation syndrome (OHSS) is a potentially serious complication associated with ovarian stimulation for assisted reproductive technology. While measures to prevent and reduce the incidence of OHSS are part of good clinical practice, OHSS still occurs, and patients may present to clinicians with varying familiarity with the condition. Diagnosis is largely clinical, although radiological and laboratory testing helps determine the severity of the syndrome. Management of moderate and severe OHSS is primarily supportive as either an outpatient or an inpatient and may include paracentesis. Critical OHSS needs hospitalization and multidisciplinary care. This clinical practice guideline assesses the published evidence regarding the diagnosis and management of patients presenting with moderate and severe OHSS.

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KEY WORDS

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Practice guideline

INTRODUCTION

Ovarian hyperstimulation syndrome (OHSS) is a potentially serious complication associated with ovarian stimulation for assisted reproductive technology (ART). Although OHSS can occur spontaneously or with oral ovulation induction agents, it is most commonly seen after ovarian stimulation with injected gonadotrophins for fertility treatments including IVF, oocyte cryopreservation or oocyte donation (*Daolio et al., 2023*; *Lemardeley et al., 2021*; *Li and Hao, 2022*; *Navot et al., 1992*; *Schenker and Polishuk, 1975*; *Tulandi et al., 1984*).

OHSS generally includes a spectrum of signs and symptoms including abdominal distension, pain and shortness of breath. In its most severe form, it is associated with ovarian enlargement, ascites, haemoconcentration, hypercoagulability and electrolyte imbalances, which could lead to thromboembolic events, ovarian torsion, multiorgan failure and death (*Braat et al., 2010*).

Preventative measures when patients are at risk of OHSS have been extensively covered in other guidelines (*ESHRE Group on Ovarian Stimulation, 2020*; *Practice Committee of the ASRM (1), 2024*; *Tsampras et al., 2025*) and are beyond the scope of this document. In brief these measures include:

- identifying patients at increased risk of OHSS and its subsequent complications (namely elevated anti-Müllerian hormone, polycystic ovary syndrome and anticipated high oocyte yield);
- tailoring the stimulation including the starting gonadotrophin dose to decrease the risk of OHSS;
- prioritizing ovarian stimulation protocols using gonadotrophin-releasing hormone (GnRH) antagonists over agonists;
- in antagonist cycles, using a GnRH agonist only to trigger oocyte maturation with the cryopreservation of all embryos as a first-line strategy in patients with an ovarian over-response;
- in patients at risk for moderate to severe OHSS, starting a dopamine agonist on the day of the trigger.

Even where preventative measures are used appropriately, a minority of patients will still develop severe OHSS (6–7/1000) and may even require hospitalization to manage the symptoms and reduce the risk of severe consequences (*Castillo et al., 2020*; *Papanikolaou et al., 2005*; *Tomás et al., 2021*). These patients may present to the emergency room or be hospitalized away from the treating ART centre.

The aim of this guideline is to provide recommendations, based on available evidence, regarding the diagnosis and management of OHSS. The target audience includes reproductive endocrinology and infertility physicians, obstetricians-gynaecologists, emergency room physicians, primary care physicians and any health professional caring for people who may be at risk of moderate or severe OHSS.

METHODS

An electronic database search (Embase, PubMed and Google Scholar) was made for publications or abstracts involving interventions for and management of OHSS from inception until May 2025. Primary source and review article reference lists were also examined. A combination of the following key words and terms were used: OHSS, ovarian hyperstimulation, IVF complications, paracentesis, thromboembolism, hospital admission and death. Studies describing strategies to prevent or reduce the incidence of OHSS were excluded. Two authors (WB and CS) identified the primary sources. A total of 255 publications were identified; after duplication and relevance had been assessed, 19 studies describing interventions to manage moderate and severe OHSS were examined. None of these were randomized controlled trials (RCT) and the majority had no control groups.

In accordance with the Canadian Fertility and Andrology Society clinical practice guideline process, the guideline development working group used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach to recommendation development, which provides a framework for the guideline development process including assessment of the quality of evidence and recommendations (*GradePro, 2023*; *Schünemann et al., 2013*). The strength of evidence is shown in TABLE 1. A strong recommendation was made when the desirable effects clearly outweighed the undesirable effects of the intervention or action, and a weak recommendation was made when the desirable effects probably outweighed the undesirable effects. In the absence of adequate evidence a consensus recommendation was made. Practice points were made where important non-evidence issues needed to be addressed, such as the diagnosis and classification of OHSS.

All members of the authorship group reviewed the studies, assessed and graded the evidence and developed the recommendations. Disagreements were discussed extensively and resolved by consensus.

DIAGNOSIS AND PRESENTATION

OHSS can be defined as the enlargement of the ovaries due to numerous post-ovulatory follicles followed by an

TABLE 1 STRENGTH OF THE PUBLISHED EVIDENCE

Strength of evidence	Definition
High	High confidence in the evidence. We are very confident that the true effect lies close to that of the estimate of the effect
Moderate	Moderate confidence in the evidence. We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Low confidence in the evidence. Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect
Very low	Very low confidence in the evidence. We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect

TABLE 2 RISK FACTORS ASSOCIATED WITH OHSS AND APPROPRIATE INVESTIGATIONS TO BE PERFORMED WHEN A PATIENT PRESENTS WITH POSSIBLE OHSS

Risk factors associated with OHSS following infertility treatment	Initial investigations when presenting with possible OHSS
PCOS diagnosis (high AMH/ovarian reserve)	Vital signs including weight
Low body mass index	Complete blood count (with haematocrit)
Treatment with injected gonadotrophins	Electrolytes, urea and creatinine
Increased number of developing follicles	Liver function tests Albumin
≥15 oocytes retrieved	Abdominal and pelvic ultrasound scans Human chorionic gonadotrophin SaO_2
Previous history of OHSS	If pleural effusion is suspected: chest X ray

AMH, anti-Müllerian hormone; OHSS, ovarian hyperstimulation syndrome; SaO_2 .Arterial oxygen saturation.

extravascular shift of protein-rich fluid. Abdominal ascites occurs and may be accompanied by pleural effusion. There are varying degrees of associated hypovolaemia, haemoconcentration, electrolyte derangements and oliguria.

Secondary complications may include hypercoagulability, thromboembolic phenomena, acute respiratory distress syndrome (ARDS), hepatorenal failure, ovarian torsion and, rarely, death.

Patients with OHSS typically present with abdominal distension and discomfort following oocyte retrieval for IVF (see TABLE 2 for risk factors for OHSS). In many cases, there is a history of a high ovarian response to stimulation (with over 15–20 oocytes), but the absence of a high response does not exclude OHSS.

Important points to note in any history should include the presence of polycystic ovaries, type of fertility treatment, use of gonadotrophins, number of oocytes retrieved, timing of human chorionic gonadotrophin (HCG) injection or oocyte retrieval (to differentiate early and late OHSS) and whether embryo transfer occurred or whether the patient is pregnant. Younger age, non-white race and infertility due to disorders of ovulation, tubal factors or unexplained infertility are associated with an increased risk of OHSS (*Jayaprakasan et al., 2012*), although age over 40 years is associated with increased risk of life-threatening complications (*Selter et al., 2019*).

Examination should include weight and abdominal girth, measures of haemodynamic stability, assessment of dehydration and chest and abdominal examination, particularly for evidence of pleural effusion and abdominal ascites and other causes of abdominal or pelvic pain. Examination of dependent tissues for oedema and evidence of thromboembolism are also important. TABLE 2 lists the initial investigations that should be ordered when OHSS is suspected.

Presentation is categorized as either early or late. Early OHSS occurs within 7 days of the oocyte retrieval and is usually associated with an excessive response to stimulation. In cases where embryo transfer was not performed, the presentation of OHSS is categorized as early. Although these early cases commonly resolve more quickly than late OHSS, appropriate management is still required. Late OHSS is associated with the rising HCG concentration of early pregnancy and presents after embryo transfer. Late OHSS tends to be more prolonged and more severe (*Mathur et al., 2000*).

TABLE 3 IMPORTANT DIFFERENTIAL DIAGNOSES WHEN PRESENTING WITH SYMPTOMS OF OHSS

Differential diagnoses of OHSS
Intraperitoneal haemorrhage
Pelvic infection
Pelvic abscess
Appendicitis
Ovarian torsion
Cyst rupture
Bowel perforation
Ectopic pregnancy

OHSS, ovarian hyperstimulation syndrome

Care must be taken to exclude important differential diagnoses (TABLE 3). OHSS is not usually associated with fever or peritonitis. Consultation with the treating fertility team should be sought wherever possible.

CLASSIFICATION AND PREVALENCE OF OHSS

There is no specific test for OHSS, and the cluster of symptoms and signs associated with OHSS is shown in TABLE 4.

Although various classification schemes for OHSS have been proposed, most authorities now categorize it into mild, moderate, severe and critical (*Mathur et al., 2000*). TABLE 4 is based on the classification schemes proposed by the Royal College of Obstetricians and Gynaecologists in 2016 (*Royal College of Obstetricians and Gynaecologists, 2016*) and the American Society for Reproductive Medicine in 2024 (*Practice Committee of the ASRM (1), 2024*). Multiple ovarian cysts on ultrasound imaging are an expected finding following IVF and this alone does not establish the diagnosis of OHSS.

Some degree of hyperstimulation is common in cycles using injected gonadotrophins where 20–33% of IVF cycles are associated with mild OHSS, are managed conservatively and usually resolve quickly. However, 1–7% of agonist IVF cycles and 0.5–1.1% of antagonist cycles result in moderate or severe OHSS (*Braat et al., 2010*; *Castillo et al., 2020*; *Papanikolaou et al., 2005*; *Tomás et al., 2021*).

TABLE 4 CLASSIFICATION OF OHSS

OHSS stage	Clinical features	Laboratory features	Imaging
Mild	Abdominal distension/discomfort Mild nausea/vomiting Mild dyspnoea	No significant alterations from TABLE 2 tests	Enlarged ovaries on ultrasound (less than 8 cm)
Moderate	Mild clinical features + Increasing abdominal distension Abdominal pain Vulval or leg swelling Reduced urine output	Haemoconcentration (haematocrit >41%)	Ultrasonographic evidence of ascites Ovarian enlargement (8–12 cm)
Severe	Mild and moderate clinical features + Clinical evidence of ascites Pleural effusion Severe dyspnoea Oliguria/anuria Intractable nausea/vomiting Hypotension or low central venous pressure Rapid weight gain (>1 kg in 24 h) Syncope Severe abdominal pain Thrombosis	Severe haemoconcentration (haematocrit >55%) White cell count >25,000 × 10^9/l Creatine > 141 μmol/l Na^+ <135 mEq/l K^+ >5 mEq/l Elevated liver enzymes	Ultrasound: Ovarian size usually over 12 cm Widespread ascites Chest X-ray: Pleural effusion Doppler scan: Arterial or venous thrombosis
Critical	Anuria/acute renal failure Arrhythmia Pulmonary embolism Pericardial effusion Massive hydrothorax Arterial thrombosis ARDS	As above	Chest X-ray: ARDS Pericardial effusion CT scan: Pulmonary embolism

ARDS, acute respiratory distress syndrome; OHSS, ovarian hyperstimulation syndrome.

Practice point:

1. OHSS is a spectrum from mild symptoms and enlarged ovaries post-IVF to a severe life-threatening illness. It is often associated with a high number of oocytes retrieved, the use of an HCG trigger for oocyte maturation or luteal support, and pregnancy.

OUTPATIENT MANAGEMENT

Hospitalization and inpatient management of patients with severe OHSS have been traditionally recommended to allow for close observation of the progression of OHSS and early detection of critical OHSS. However, case series and observational studies have shown that outpatient management of moderate and selected cases of severe OHSS can be safe and effective (*Fluker et al., 2000*; *Gebril et al., 2018*; *Shrivastav et al., 1994*).

Clinics should have established criteria to identify those at increased risk of OHSS, protocols for close monitoring and the ability to perform regular assessment and management of these patients. Patients must be able to present for regular follow-up and understand when to report worsening symptoms. OHSS educational information and clinic contact details should be given (see FIGURE 1 for an example).

Monitoring

Individuals with OHSS should be given verbal and written information explaining the diagnosis and natural self-limiting course of OHSS (FIGURE 1).

There are no specific studies to guide advice regarding fluid intake. However, it appears reasonable to encourage patients to drink to thirst rather than with an arbitrary amount (*Royal College of Obstetricians and Gynaecologists, 2016*) in order to maintain their normal urine output. A normal urine output is 0.5–1.0 ml/kg per hour (around 800–2000 ml per 24 h) (*Al-Kazwini and Simhadri, 2025*). In the absence of symptomatic improvement, patients should be seen every 2–3 days and undergo physical examination, ultrasound scans and biochemical and haematological assessment until resolution.

Although not specified in the studies examined, sexual intercourse and high impact physical activities might worsen abdominal pain and increase the risk of ovarian torsion. However, mobilization should be encouraged to reduce the risk of thromboembolic events.

Symptoms and signs requiring hospitalization include severe abdominal pain, intractable nausea and vomiting, severe oliguria or anuria, tense ascites, dyspnoea or tachypnoea, hypotension or evidence of thromboembolism (TABLE 4 and FIGURE 1). Laboratory indicators of critical OHSS include worsening haemoconcentration, electrolyte imbalance (TABLE 4) and abnormal liver and renal function.

Recommendation:

1. Clinics and practitioners prescribing gonadotrophins should have established criteria to identify those at increased risk of OHSS, protocols for close monitoring, and

What is ovarian hyperstimulation syndrome (OHSS)?
Ovarian hyperstimulation syndrome (OHSS) happens when your ovaries become enlarged and fluid collects in your abdomen. OHSS is a complication that typically occurs in people who receive fertility treatments that stimulate their ovaries to produce many eggs.
Who gets OHSS?
All individuals undergoing ovarian stimulation during fertility treatment are at risk of developing OHSS. Mild OHSS can occur in 1/3 (33%) of those having treatment. Moderate/severe OHSS in less than 5/100 individuals (under 5%)
How long does OHSS last?
This can take a few days to a few weeks to resolve depending on the severity and management plan undertaken. Treatment focuses on managing symptoms until the condition resolves on its own.
What should I do when I have OHSS?
Take pain killers, such as Tylenol (Acetaminophen), regularly or as needed. Do not take Nonsteroidal Anti-Inflammatory Drugs (such as Advil or Naproxen). Drink fluids to thirst, but not to excess. Weigh yourself every day. Monitor how often you are passing urine. Avoid strenuous exercise and sexual activity until symptoms are resolved. Discuss any treatment related medication with your IVF team. Regular monitoring and assessment of symptoms should be done as per your clinic's protocol.
When should I contact the IVF clinic
You should contact the clinic if symptoms are worsening or not resolving.
When should I go to the ER?
Your symptoms are worsening and you are unable to contact or seek advice from your clinic. When the pain is uncontrollable. When you have persistent vomiting or are unable to drink When you are unable to pass urine. When you have chest pain or difficulty breathing. When you have severe leg or severe vulvar swelling.
Contact details of the IVF provider

FIGURE 1 Information for patients with moderate to severe ovarian hyperstimulation syndrome (OHSS). ER, emergency room

regular assessment of these patients until symptom resolution.

Strength: strong.

Consensus recommendation.

Analgesia

Acetaminophen with or without a narcotic agent, or oral opiates, can be offered to individuals for pain relief. Non-steroidal anti-inflammatory drugs should be avoided as they may compromise renal function in individuals with OHSS (*Balasch et al., 1990*), as they do in patients with pre-renal failure and hypovolaemia (*LaForge et al., 2023*). Peri-conceptual use of naproxen is also associated with lower fecundability and may have an effect on embryo implantation (*McInerney et al., 2017*).

Hormonal management

Pregnancy and rising HCG is associated with worsening OHSS. Therefore, in cases of early OHSS fresh embryo transfer should not be performed.

The use of a GnRH agonist only for final oocyte maturation is associated with rapid luteolysis and a deficient luteal phase. This is one reason why agonist triggering works well in reducing the risk of severe OHSS, particularly when combined with a freeze-all approach (*Practice Committee of the ASRM (1), 2024*). However, in cases where embryo cryopreservation is not possible or embryo transfer has already been performed, HCG support in varying doses and timings in the luteal phase has been proposed (*Haas et al., 2014*; *Yding Andersen et al., 2016*) and comparable pregnancy rates have been reported. Nevertheless, these approaches are still associated with a 5–10% risk of severe OHSS (*Santos-Ribeiro et al., 2020*). In cases where severe OHSS develops, no further HCG should be given.

Small observational studies (*Lee et al., 2017*; *Mills and Dahan, 2022*) have suggested that GnRH antagonist administration in individuals with established severe early OHSS may result in quicker regression of the syndrome. However, GnRH antagonists should not be used in an ongoing pregnancy and there have been no published data evaluating their efficacy in late/severe OHSS.

Similarly, small case series and observational studies have suggested that dopamine agonists (*Manalai et al., 2021*; *Naredi et al., 2018*; *Rollene et al., 2009*) may have a beneficial role in the treatment of established moderate or severe OHSS. These describe doses of cabergoline from 0.25 to 1 mg daily for 3–8 days. All demonstrate an eventual resolution of OHSS symptoms and signs, although there were no comparative groups.

It is unclear whether cabergoline may have a negative effect in pregnancy — two cohort studies (not related to OHSS) have demonstrated that cabergoline use in the first trimester may be associated with an increased risk of early fetal loss (*Hurault-Delarue et al., 2014*; *Stalldecker et al., 2010*), while a recent review suggested there was no negative impact, although study quality was low (*Otis et al., 2025*). Further research is required.

Letrozole has been proposed to reduce the risk of OHSS, although small studies have shown conflicting results (*Mai et al., 2017*; *Wang et al., 2015*). Current guidelines do not recommend the use of letrozole to prevent OHSS (*Practice Committee of the ASRM (1), 2024*). No comparative studies have evaluated letrozole in the treatment of established OHSS. Letrozole has been shown to reduce serum oestradiol concentrations after ovarian stimulation, but whether this will reduce hyper-oestrogenic sequelae such as thromboembolic events is conjecture.

Recommendations:

2. Fresh embryo transfer should not be performed in patients with moderate and severe OHSS.

Strength: strong.

Consensus recommendation.

3. Luteal phase HCG is associated with increased OHSS progression and should

be avoided in cases of moderate and severe OHSS.

Strength: strong.

Consensus recommendation.

4. Starting GnRH antagonists, cabergoline or letrozole to hasten symptom resolution or prevent thrombotic complications in individuals diagnosed with moderate, severe or critical OHSS is generally not recommended.

Strength: weak

Quality of evidence: very low.

Fluid balance

Maintenance of intravascular volume can prevent serious complications associated with OHSS and the goal is to maintain a normal urine output. Although intravenous albumin, hydroxyethyl starch, mannitol, polygeline and dextran have been reported as possible interventions for the prevention of OHSS (*Youssef and Mourad, 2016*), there are no trials on the optimum regimen for managing fluid balance in patients with established moderate and severe OHSS. Theoretically, aggressive intravenous fluid therapy with crystalloids has the potential to worsen ascites in the presence of the increased capillary permeability associated with OHSS. Therefore, the oral route should be used for hydration wherever possible. Some patients may need effective analgesia and antiemetics to be able to drink and maintain adequate fluid balance.

Patients must receive clear instructions when there is evidence of fluid imbalance such as uncontrolled nausea and vomiting, significant weight gain or decreased urine output. Acute dehydration warrants intravenous fluid therapy in conjunction with close monitoring and frequent reassessment.

Thromboprophylaxis

Severe OHSS is a prothrombotic state due to haemoconcentration and vascular endothelial dysfunction. The incidence of thrombosis has been estimated to lie between 0.7% and 2% of OHSS cases. Rova and colleagues reported on the risk of thromboembolism in early pregnancy in relation to IVF and OHSS comparing 19,162 IVF pregnancies and 935,178 non-IVF pregnancies (*Rova et al., 2012*). The incidence of venous thromboembolism (VTE) in the first trimester in non-IVF pregnancies was 0.2 per 1000, while the incidence in IVF pregnancies with no OHSS was 0.8 per 1000 (odds ratio [OR] 4.8, 95% confidence interval [95% CI] 2.7–8.7), compared with 16.8 VTE events per 1000 for those who developed OHSS (OR 99.7, 95% CI 61.6–161.1). The study period was from 1999 to 2008.

A subsequent systemic review (*Sennstrom et al., 2017*) including nine cohort and six case-controlled studies demonstrated a doubling (OR 2.18, 95%CI 1.63–2.92) of thromboembolism risk in early pregnancy following IVF compared with non-IVF pregnancies and even higher risks during the first trimester following OHSS.

VTE risk also appears to be higher after IVF in patients who do not become pregnant (OR 1.74, 95% CI 1.30–2.34), although it is unknown how many of these, if any, had OHSS (*Filipovic-Pierucci et al., 2019*).

Despite the high thrombotic risk after ART, the absolute risk of VTE in all patients who use ART in Canada is estimated to be 1% or lower (*Smith J et al., 2021*).

Unfortunately, there are no comparative studies addressing the efficacy of thromboprophylaxis in patients with severe OHSS. A systematic review of retrospective cohort and of case-controlled studies used a decision tree cost-effectiveness model to estimate the efficacy of thromboprophylaxis (*Cormerford Wormer et al., 2018*).

Nevertheless, given the absolute risk of thromboembolism in patients with OHSS is around 1.7% (*Rova et al, 2012*; *Sennstrom et al., 2017*) and the potentially life-threatening nature of thromboembolism thromboprophylaxis should be strongly considered.

Low molecular weight heparin at a prophylactic dose is safe and recommended in pregnancy (*Royal College of Obstetricians and Gynaecologists, 2015*) and therefore should be the pharmacological intervention of choice. Anti-embolism TED stockings should be used in patients admitted to hospital with OHSS for whom pharmacological thromboprophylaxis is contraindicated, as they are likely to have reduced mobility.

There is no agreement on the duration of thromboprophylaxis in OHSS. As noted above, several reports describe the increased thromboembolism risk occurring weeks after the apparent resolution of OHSS, particularly in association with pregnancy (*Chan, 2009*; *Yinon et al., 2006*). The majority of delayed thromboses are reported to have occurred within the first trimester of pregnancy. Hence, in those with severe OHSS who conceive, thromboprophylaxis should be considered at least until the end of the first trimester.

In general, the duration of thromboprophylaxis should be based on individual risk factors and not just whether pregnancy is achieved. Liaison with a haematologist may be beneficial in individualizing therapy.

Thrombosis in individuals with OHSS frequently affects upper body sites and often involves the arterial system (*Grandone et al., 2025*). Therefore, clinicians should remain vigilant of patients presenting with unusual symptoms such as dizziness, loss of vision or arm and neck pain.

Where thrombosis suspected, hospital admission is warranted.

Recommendation:

5. Patients with severe OHSS or those admitted to hospital with OHSS should receive low molecular weight heparin thromboprophylaxis. The duration of therapy should be individualized based on risk factors for thromboembolism and whether the patient is pregnant.

Strength: strong.

Consensus recommendation.

Early outpatient paracentesis

Paracentesis in patients with severe OHSS is usually associated with a significant improvement of symptoms (*Fluker et al., 2000*; *Shrivastav et al., 1994*; *Smith L et al., 2009*). Paracentesis is carried out under ultrasound guidance and is usually performed vaginally in the outpatient setting.

Haemoconcentration can be reversed after early paracentesis and rehydration (*Delbaere et al., 1994*; *Fluker et al., 2000*;). Removal of ascitic fluid lowers intra-abdominal pressure, potentially increasing renal blood flow and thereby improving renal function (*Lincoln et al., 2002*). It has also been suggested that removal of the

inflammatory and vasoactive materials produced by the hyperstimulated ovaries may be a mechanism for improving the severity of the condition (*Delbaere et al., 1994*; *Maslovitz et al., 2004*).

Shrivastav and collaborators published the first retrospective case series reporting safe outpatient management of severe OHSS (*Shrivastav et al., 1994*). Fluker and colleagues reported a small prospective cohort study of 13 patients managed on outpatient basis with early transvaginal paracentesis and albumin administration (*Fluker et al., 2000*). All patients were managed successfully on outpatient basis without hospital admission. Similar findings were noted by Lincoln and co-workers, who reported a series of 48 patients with severe OHSS managed on outpatient basis with transvaginal paracentesis and rehydration (*Lincoln et al., 2002*). Smith and collaborators reported a larger scale retrospective case series of 183 patients with OHSS who were managed on an outpatient basis over an 8-year period from 1999 to 2007; they showed a significant reduction in the need for hospitalization with early and frequent paracentesis (*Smith L et al., 2009*).

There are no published RCT comparing early outpatient paracentesis versus standard care in moderate or severe OHSS, although an RCT protocol has been published, and the trial is ongoing (*White et al., 2024*)

It is unknown what is the optimal or safe volume of fluid to be removed during a single paracentesis, the time over which the fluid should be drained or the route of drainage. In Smith and collaborators' series, the mean volume of fluid removed was over 2000 ml and no complications were reported (*Smith L et al., 2009*).

Patients with OHSS are generally younger and are likely to more easily tolerate the removal of large volumes of ascites compared with elderly patients with malignant disease.

Patients who have repeated paracenteses may require colloid replacement.

Recommendation:

6. Outpatient paracentesis can be offered to symptomatic patients with moderate or severe OHSS.

Strength: strong.

Quality of evidence: moderate.

HOSPITAL (INPATIENT) MANAGEMENT

Criteria for admission

The benefit of hospital admission can be closer monitoring, ease of intervention and availability of multidisciplinary input. This is crucial in the care of patients with critical OHSS who have already developed severe complications and who may require intensive care.

There is variability in the threshold for hospital admission between individual IVF providers and the emergency room and differing hospital admission policies. Despite significant increases in IVF use over the past decade (*Canadian Assisted Reproductive Technologies Register, 2025*; *Society for Assisted Reproductive Technology – Clinic Outcome Reporting System, 2025*), emergency room presentation rates for OHSS in the USA have remained relatively stable and admission rates for OHSS have fallen (*Schon et al., 2022*).

A retrospective observational study using a large database covering 11,878 patients with OHSS treated at 735 hospitals across the USA (*Bainvoll et al., 2022*) demonstrated lower rates of major complications in facilities managing more OHSS patients (high-volume hospitals: 11.0%; mid-volume hospitals: 15.2%; low-volume hospitals: 15.6%, $P < 0.001$). On multivariable analysis, treatment at high-volume hospitals was independently associated with a nearly 20% lower rate of major complications (OR 0.82, 95% CI 0.70–0.97, $P = 0.021$).

IVF clinics, gynaecology services and emergency room departments should develop local protocols and referral pathways for OHSS management and have input from clinicians with experience of OHSS or processes to be transferred to such centres.

The need for intravenous fluid management or paracentesis is not an absolute indication for admission and depends on local availabilities and policies.

Nevertheless, hospital admission should be considered for individuals who are unable to achieve satisfactory pain control, have intractable vomiting and are unable to maintain an adequate fluid intake, show signs of worsening OHSS despite outpatient intervention, are unable to attend for regular outpatient follow-up or have critical OHSS (**TABLE 4** and **FIGURE 1**).

Inpatient monitoring

The inpatient management of OHSS is largely based on expert opinion rather than evidence. It has been suggested that patients should have daily physical examination and vital signs, abdominal girth measurements at the level of the umbilicus, daily weight and fluid balance recorded (*Kwik et al., 2015*; *Practice Committee of the ASRM (2), 2008*; *Royal College of Obstetricians and Gynaecologists, 2016*).

Recommendations for the frequency of general observations should be dictated by patient status, and keeping of a strict fluid balance record is recommended. Daily venepuncture to analyse a complete blood count and serum biochemistry has been recommended, including albumin and liver function (*Kwik et al, 2015*; *Royal College of Obstetricians and Gynaecologists, 2016*).

Coagulation studies will not predict thrombotic events and therefore are not recommended routinely. However, thromboprophylaxis should be started.

Other published recommendations include placement of an in-dwelling urinary catheter if oliguria is present, ultrasound imaging to monitor ascites and determine the need for drainage or to assess for ovarian torsion or other complications, and performing a chest X-ray if pleural or pericardial effusion is suspected.

Increasing waist circumference, weight gain, oliguria with positive fluid balance and elevated haematocrit are signs of worsening OHSS. Patients with severe OHSS where dehydration and haemoconcentration persist despite adequate fluid replacement may need invasive haemodynamic monitoring, requiring input from anaesthesia and internal medicine/intensive care teams (*Royal College of Obstetricians and Gynaecologists, 2016*; *Shmorgun and Claman, 2017*).

Intensive care is also likely to be needed for individuals with critical OHSS, while specific complications such as thromboembolism, ARDS and renal failure will require input from the relevant

specialties. These acute complications should be managed in the usual manner with appropriate hospital policies.

Analgesia

Pain relief should be managed similarly to outpatient care, although the use of parenteral opiates is appropriate where pain is uncontrolled despite these measures. Paracentesis also delivers significant pain relief (*Fluker et al., 2000*; *Shrivastav et al., 1994*).

Fluid balance

There are no RCT trials on the optimum regimen for managing fluid balance in OHSS. Acutely dehydrated patients may need intravenous fluid therapy to correct fluid balance, followed by oral fluids to maintain hydration. Crystalloids (either normal saline or a balanced crystalloid solution) are useful for the initial correction of dehydration in individuals who are unable to maintain adequate oral intake. There are theoretical advantages to using colloids rather than crystalloids for initial rehydration.

Restoration of adequate intravascular volume must always remain the first priority to ensure appropriate tissue perfusion and prevent the development of multiorgan failure. Correction of hypovolaemia, hypotension and decreased renal perfusion takes precedence, accepting that fluid administration may contribute to the accumulation of ascites (*Chen et al., 2011*).

Persistent haemoconcentration or low urine output despite apparent adequate volume replacement by colloids is an indication to seek multidisciplinary assistance. In these cases, continuous urine output measurement and invasive haemodynamic monitoring may help guide fluid management more accurately. Intravascular resuscitation should be titrated to maintain an adequate urine output (20–30 ml/h) and to reverse haemoconcentration. Oliguria despite adequate fluid replacement may in some cases respond to paracentesis.

Recommendations:

7. Oral fluid replacement guided by thirst should be used to correct dehydration.

Strength: weak.

Consensus recommendation.

8. Where oral rehydration is insufficient or impossible, intravenous hydration should be initiated with a crystalloid solution.

Strength: strong.

Consensus recommendation.

9. Complex fluid management should involve multidisciplinary input.

Strength: strong.

Consensus recommendation.

Electrolyte imbalance

Correction of severe electrolyte abnormalities plays an important role in OHSS management.

Salt or water restriction is not recommended, as this does not affect the patient's weight, peripheral oedema, intravascular volume status or abdominal circumference (*Chen et al., 2011*).

Management of complex electrolyte imbalances such as hyperkalaemia and hyponatraemia should be performed by those with appropriate expertise.

Ascites (with inpatient paracentesis)

Indications for paracentesis include: (i) severe abdominal distension and abdominal pain secondary to the ascites; (ii) shortness of breath and respiratory compromise also secondary to ascites and increased intra-abdominal pressure; and (iii) oliguria despite adequate volume replacement, secondary to increased abdominal pressure causing reduced renal perfusion.

General comments on paracentesis are included in 'Early outpatient paracentesis' above.

Paracentesis has been associated with a shorter hospital stay (a reduction of several days) when compared with those who do not have paracentesis. Qublan and colleagues studied 65 inpatients who had multiple transvaginal paracenteses and found they had significantly shorter lengths of stay and significantly lower intravenous fluid replacement when compared with inpatients who had fewer than three paracenteses (*Qublan et al., 2012*).

Insertion of a transabdominal indwelling pigtail catheter circumvents the need for multiple attempts at vaginal or abdominal drainage and limits the potential for complications from more than one procedure (*Rahami et al., 1997*). The ascites output should be recorded daily. Clinical resolution is achieved when the paracentesis output starts to decrease as urine output increases. When the ascites output is less than 50 ml/day the catheter can be removed (*Shmorgun and Claman, 2017*).

Recommendation:

10. Repeated inpatient paracentesis can be offered to patients with moderate or severe OHSS and symptomatic ascites to reduce hospital stay.

Strength: strong.

Quality of evidence: low.

Management of severe complications

Renal failure, thromboembolism, pericardial effusion and ARDS are potential life-threatening complications of OHSS. These conditions should be diagnosed early and managed by a multidisciplinary team possibly in an intensive care unit setting.

Surgical intervention

Surgery should be reserved for adnexal torsion or active intra-abdominal bleeding.

Hyperstimulated ovaries are likely to be highly vascular and liable to damage on handling. The presence of ovarian enlargement and ascites should be kept in mind when considering a diagnosis and management of ectopic pregnancy.

Rarely, termination of pregnancy may be indicated in severe OHSS.

Recommendation:

11. In the absence of ovarian torsion or active intra-abdominal bleeding, ovarian surgery should not be carried out for the management of OHSS.

Strength: strong.

Consensus recommendation.

CONCLUSIONS

OHSS is a known complication of IVF. Ideally, patients at risk for this disorder should be identified prior to gonadotrophin stimulation, and preventative measures selected in order to

minimize the risk of developing severe OHSS.

In cases where OHSS develops, it is mild to moderate most of the time and self-limiting. In severe OHSS, treatment involves the alleviation of symptoms and management of complications.

Overall levels of evidence are low and there are very few comparative studies on inpatient and outpatient management practices for moderate and severe OHSS. There is no RCT-level evidence. Therefore, most recommendations are based on low-quality evidence and best practice.

Hospital admission and care for critical OHSS may require a multidisciplinary team approach.

DATA AVAILABILITY

Data will be made available on request.

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