orphanaesthesia

Anaesthesia recommendations for

Preeclampsia

Disease name: Preeclampsia

ICD 10: 014.0, 014.1, 014,2, 014.9

Synonyms: Preeclampsia, Pre-eclampsia, Toxaemia of pregnancy, Toxaemia of pregnancy, Toxaemia

Disease summary: Preeclampsia is a systemic disease of pregnancy: it currently affects approximately 7.5% of pregnancies globally and is increasing in incidence. Although the precise aetiology is unknown, the disease is characterized by widespread endothelial dysfunction associated with the down-regulation of proangiogenic factors (e.g., soluble Flt-1 [SFlt-1] and soluble endoglin [sEng]). Numerous clinical practice guidelines define and guide management of this complex disease; these include recommendations from the United States (American Congress of Obstetricians & Gynecologists [ACOG]), Canada (Society of Obstetricians and Gynaecologists of Canada [SOGC]), the United Kingdom (National Institute for Health and Care Excellence [NICE]), New Zealand, and the World Health Organization (WHO).

Preeclampsia is broadly defined as BP ≥ 140/90 on two separate occasions, 6 hours apart, after 20 weeks' gestation, with proteinuria (≥ 300 mg/24h). The 2013 ACOG guidelines for hypertensive disorders of pregnancy stipulate that a pregnant or newly postpartum woman has severe preeclampsia if she meets blood pressure criteria and exhibits any signs or symptoms of organ system dysfunction (e.g., headache, visual disturbances, pulmonary oedema, or right upper quadrant pain), irrespective of whether there is documented proteinuria.

Prompt diagnosis of preeclampsia is of paramount importance. Ultimately, the cure for preeclampsia is delivery of the foetus, with temporizing measures targeting pharmacologic treatment of hypertension and seizure prevention with magnesium sulfate. Antenatal corticosteroid administration to promote foetal lung maturation is recommended prior to 34 weeks' gestation (or 37 weeks' gestation when delivery is probable within 7 days) [1].

The diagnosis of preeclampsia is associated with both maternal morbidity (e.g., eclampsia, HELLP syndrome) and foetal risks (e.g., placental abruption, impaired uteroplacental perfusion or intrauterine growth restriction) as well as future maternal cardiovascular and cerebrovascular disease. The risks posed to the foetus increase the chance of urgent or emergency cesarean delivery.

Medicine is in progress

Perhaps new knowledge

Every patient is unique

Perhaps the diagnosis is wrong

Find more information on the disease, its centres of reference and patient organisations on Orphanet: www.orpha.net

Typical surgery

The mode of delivery (i.e., vaginal or cesarean) for a woman with preeclampsia depends upon the severity of illness, the foetal gestational age, and the likelihood of a successful vaginal delivery [2]. Whenever feasible, a vaginal delivery is typically preferred. Cesarean delivery is reserved for obstetric indications or for cases where imminent delivery is needed based on maternal or foetal condition, and the woman is remote from vaginal delivery (for example, due to an unfavourable cervix).

Expectant management involves observation, corticosteroid administration prior to 34 weeks' gestation, magnesium sulfate, antihypertensive medications, and ongoing maternal and foetal monitoring. The presence of eclampsia, pulmonary oedema, disseminated intravascular coagulation, uncontrollable severe hypertension, and placental abruption are generally considered to be contraindications to expectant management and may necessitate urgent delivery.

Due to a higher incidence of associated conditions such as placental abruption and foetal intrauterine growth restriction, pregnant women with preeclampsia are more likely to need an emergency cesarean delivery than women without preeclampsia.

Type of anaesthesia

Neuraxial (spinal, epidural, or combined spinal-epidural) blockade is usually the technique of choice for labour or cesarean delivery in a patient with preeclampsia. This technique helps to minimize circulating catecholamines and avoid a potentially high-risk general anaesthetic. Safe delivery of neuraxial anaesthesia may be complicated by coexisting thrombocytopenia in preeclampsia. However, the majority of women with preeclampsia will be appropriate candidates for neuraxial anaesthesia.

For labour: In patients presenting with preeclampsia, the early initiation of continuous lumbar epidural analgesia or combined-spinal epidural (CSE) analgesia are the preferred methods of pain management. These techniques provide high-quality analgesia, a reduction in circulating catecholamines, and potential improvement in intervillous blood flow. Furthermore, an in situ epidural catheter can be used in the event of an emergency cesarean delivery to attain a surgical anaesthetic.

For cesarean delivery: In the absence of a contraindication to neuraxial anaesthesia or an indwelling epidural, spinal anaesthesia has been shown to be a reasonable anaesthetic option for cesarean delivery, even in women with severe preeclampsia. Spinal anaesthesia may cause a higher incidence of hypotension than epidural anaesthesia; however, this hypotension is typically transient, and easily treated [3,4]. Women with severe preeclampsia actually experience less frequent and less severe spinal-induced hypotension than do otherwise healthy women [5]. Differences in foetal outcomes, as measured by Apgar scores and umbilical artery blood gases were not statistically significant between women with severe preeclampsia that received spinal versus epidural anaesthesia. Use of a background infusion of bolus doses of phenylephrine as an adjunct to spinal or epidural anaesthesia can help to maintain maternal blood pressure in the target range (e.g. 140-150/80-100 mmHg).

General anaesthesia may be indicated in the setting of urgent/emergent delivery without time for neuraxial anaesthesia placement, ineffective neuraxial anaesthesia, or concern for increased risk of spinal or epidural haematoma with neuraxial anaesthesia. There are several potential challenges related to general anaesthesia in a woman with severe preeclampsia:

- Endotracheal intubation may be difficult because of airway oedema. Difficult airway equipment (such as video laryngoscopy and intubating stylets) and an obstetric difficult airway algorithm should be readily available [6-8].

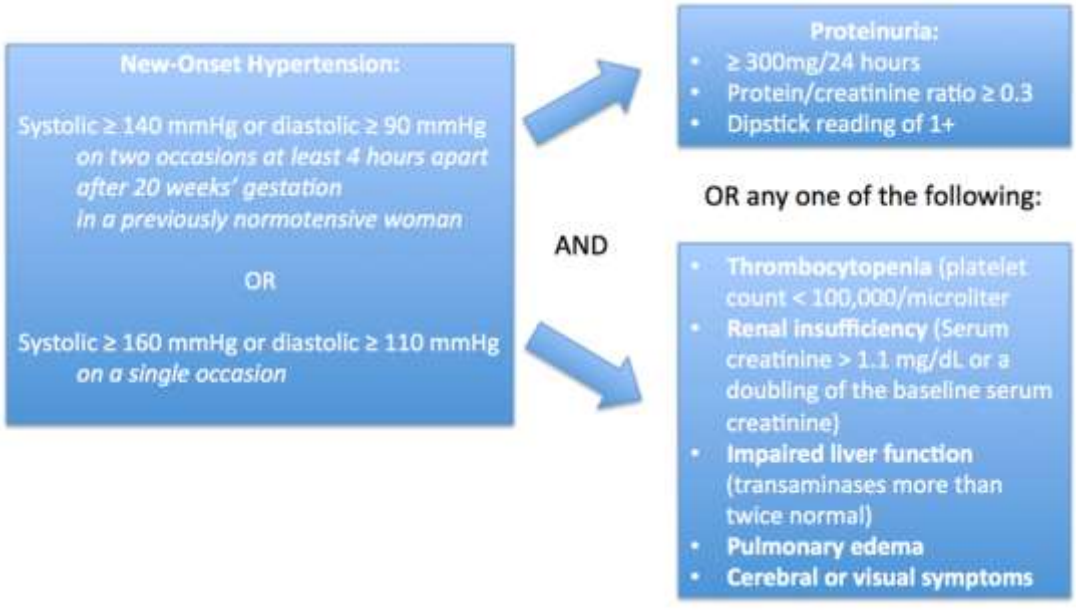
- Transient but severe hypertension that can accompany tracheal intubation and extubation may have catastrophic consequences in these patients; as such, adding a second pharmacologic agent (beyond any initial antihypertensive treatment such as β-adrenergic blocking agents [e,g., labetolol], opioids [e.g., remifentanil], lidocaine or nitroglycerin) can help to blunt a potentially-dangerous hypertensive response to laryngoscopy [9,10].

- Finally, co-administration magnesium sulfate (MgSO4) and a non-depolarizing muscle relaxant can result in prolonged muscle weakness and respiratory insufficiency upon extubation.

Necessary additional pre-operative testing (beside standard care)

Prompt recognition of preeclampsia, leading to expedited management, has the potential to limit maternal morbidity and mortality. Efforts to standardise (and therefore accelerate) diagnosis and treatment of obstetric hypertensive disorders can be especially important in resource-poor areas or in facilities that may not routinely encounter obstetric hypertension (e.g., outpatient primary care settings). One such effort, the multidisciplinary National Partnership for Maternal Safety's Consensus Bundle on Severe Hypertension During Pregnancy and the Postpartum Period, offers evidence-based guidelines that include standard diagnostic criteria, lists of essential medications and protocolised treatment guidelines, and suggested policies for triage and escalation, and process/outcome metrics [11].

In a review of 13 clinical practice guidelines from national and multinational organizations, wide variation was seen in the definitions of preeclampsia and severe preeclampsia (including blood pressure cutoffs, requirements for the presence of proteinuria, and evidence of end-organ dysfunction) [12]. In the United States, the diagnosis of preeclampsia is based on the combination new-onset hypertension plus either proteinuria alone (preeclampsia without severe features) or without proteinuria but with a finding of end-organ dysfunction (severe preeclampsia).



Suggested pre-delivery testing includes:

1) A thorough past medical history and current review of systems in any pregnant or newly postpartum woman presenting with new-onset hypertension to evaluate for signs and symptoms of end-organ involvement (visual disturbances, right upper quadrant or epigastric pain, nausea or vomiting, headache, or dyspnea) [13].

2) Careful evaluation of the airway, noting that supraglottic oedema may complicate intubation.

3) Recording of baseline blood pressure with ongoing measurement (typically non-invasive), to facilitate pre-delivery antihypertensive therapy within a target range (e.g., 140-150/80-100 mmHg).

4) Haematology labs (including haematocrit or haemoglobin and platelet count) with coagulation studies as needed.

    a. If the patient has disseminated intravascular coagulation (DIC) or severe thrombocytopenia (see below), then prolonged prothrombin time (PT), prolonged activated partial thromboplastin time (aPTT), or reduced fibrinogen concentration may be present [14,15].

    b. Note that there is no well-defined minimum platelet count at which neuraxial anaesthesia is considered to be safe in terms of the overall risk of spinal epidural haematoma in pregnant women or pregnant women with preeclampsia. As with any comorbidity, the choice of anaesthetic involves weighing the relative risks and benefits, in this case, between neuraxial anaesthesia versus general anaesthesia. The largest case series of thrombocytopenic obstetric patients undergoing neuraxial placement examined 1,524 parturients with platelet counts of less than 100,000 mm^{-3} and found no cases of spinal epidural haematoma requiring surgical decompression; the upper bound of the 95% confidence interval for haematoma risk was 0.2% for 70,000–100,000 mm^{-3}, but increased to 3% for a platelet count between 50,000 and 69,000 mm^{-3} [16]. These data, and results of small studies with thromboelastography in preeclamptic pregnant patients suggest that if the patient has no other contraindications to neuraxial anaesthesia, a platelet count between 70–80,000 mm^{-3} may be a reasonable threshold for considering neuraxial anesthesia [17,18].

5) Urine analysis: urine protein-creatinine ratio or 24-hour urine protein excretion.

6) Serum chemistries, including renal function and liver function tests (including uric acid).

    a. Elevated or rising creatinine (Cr) beyond the baseline low value in pregnancy, with or without oliguria, can be an ominous sign of increasing renal involvement.

    b. Elevated transaminases (SGOT, SGPT) suggest hepatic congestion and, if coupled with thrombocytopenia, may be a sign of the haemolysis, elevated liver enzymes, and low platelets (HELLP syndrome).

7) Foetal monitoring: non-stress test or biophysical profile.

Particular preparation for airway management

As with any parturient, airway and pregnancy-related respiratory changes (e.g., weight gain, increase in breast size, decreased functional residual capacity, increased oxygen consumption, and reduced lower oesophageal sphincter tone) result in increased incidence of failed intubation. Due to an increased risk of aspiration, rapid sequence induction is recommended, although the precise gestational age at which this full stomach of pregnancy begins is not well defined [19]. Video laryngoscopy and other airway adjuncts that maximize the glottic view may be particularly useful in these patients. As always, rescue airway devices (e.g., LMA and intubating stylets/bougies) should be available. Multiple different obstetric difficult airway algorithms are available for clinical guidance [20].

In the preeclamptic patient, the anaesthesia provider should anticipate the potential for additional difficulty visualizing the glottis or intubating due to supraglottic or glottic oedema. Additionally, attention must be given to attenuating the hypertensive response to laryngoscopy, as this can be severe enough in a hypertensive preeclamptic patient to result in cerebral haemorrhage or pulmonary oedema. A recent review of this topic recommends esmolol 1.5 mg/kg or nitroglycerin 2 µg/kg, combined with propofol 2 mg/kg, as a first-line induction regimen, with labetalol or remifentanil as second-line adjunct agents [10].

Particular preparation for transfusion or administration of blood products

Preeclamptic patients are at risk of haemorrhage and subsequent blood product transfusion due to the possibility of abruption, which occurs in 2% of women with preeclampsia, and of abnormal clotting (through isolated thrombocytopenia or the occurrence of coagulopathy, DIC, or HELLP syndrome).

In the event of maternal haemorrhage, communication with the obstetrician about delivery of the foetus should occur simultaneously with the stabilization of the mother. Maintenance of uteroplacental perfusion is critical. If not already present, large-bore IV access should be obtained rapidly to facilitate resuscitation. Vasopressors may be initiated, keeping in mind that preeclamptic women may often have an increased sensitivity to their effect, particularly if ephedrine is used [21]. Phenylephrine is the widely considered to be the vasopressor of choice in the obstetric population, but judicious use of ephedrine is generally considered to be safe and effective [22].

While non-invasive blood pressure monitoring is adequate for uncomplicated preeclampsia, invasive hemodynamic monitoring (i.e., intra-arterial monitoring, with or without central venous access) may be indicated in the setting of acute haemorrhage with haemodynamic instability.

Transfusion of blood products should proceed as it would for any other peripartum haemorrhage patient, with the knowledge that thrombocytopenia and coagulopathy may be present and will require correction.

Following large-volume resuscitation, the patient should be monitored for the development of pulmonary oedema. Pulmonary oedema occurs in 3% of preeclamptic women as a result of low plasma osmotic pressure and increased vascular permeability, and this risk is highest in the postpartum period. A large transfusion burden will worsen this risk [23,24]. For this reason, the resuscitation strategy should minimize excessive volume while correcting coagulopathy.

Particular preparation for anticoagulation

None.

Particular precautions for positioning, transportation and mobilisation

None.

Interactions of chronic disease and anaesthesia medications

Magnesium sulfate (MgSO4) is recommended by several international clinical practice guidelines for multiple different indications in preeclampsia, which include foetal neuroprotection (before 32 weeks' gestational age) and/or maternal seizure prophylaxis and for short-term prolongation of pregnancy in women at risk of preterm labour. While MgSO4 is not a primary antihypertensive agent, intrapartum use of MgSO4 in the setting of antihypertensive medications and neuraxial or general anaesthesia can lead to maternal hypotension. In the event of a general anaesthetic, concurrent use of magnesium and non-depolarising neuromuscular blockade can lead to prolonged neuromuscular blockade.

Anaesthetic procedure

Early obstetric anaesthesiology consultation is suggested as soon as preeclampsia is identified and the patient is admitted for observation or delivery. As discussed above, early epidural catheter placement is advantageous as it can avoid the bleeding challenge of performing the procedure in the setting of thrombocytopenia or coagulopathy. Especially in the subset of preeclamptic patients with HELLP syndrome, there may be a limited window during which the platelet count is deemed acceptable for performing a neuraxial anaesthesia.

Ultimately, the decision to proceed involves a risk-benefit analysis weighing the perceived risk of spinal epidural haematoma against the likelihood of general anesthesia in a patient and the risk associated with a potentially-difficult airway and a foetus with a compromised placenta. If an epidural catheter is placed in the setting of thrombocytopenia, it is prudent to avoid removal of the catheter until the platelet count has recovered.

Should urgent cesarean delivery be indicated, the following anaesthetic management guidelines are suggested:

Preoperative:

- Access: Large-bore peripheral intravenous access is recommended due to potential for haemorrhage and coagulopathy.

- Monitors: Use of an arterial line for blood pressure monitoring is not routinely necessary (as per ACOG guidelines) but is recommended in the setting of haemorrhage or difficult-to-control blood pressure [25]. Pulmonary artery pressure monitoring is rarely indicated and may be harmful if catheter insertion leads to delays in obstetric care or if bleeding occurs due to coagulopathy or thrombocytopenia. For those reasons, transthoracic echo (TTE) and non-invasive cardiac output monitoring are actively under investigation as alternative approaches [26,27].

- Verify difficult airway algorithm and emergency airway equipment are readily available.

- Control of hypertension: Early intervention to control maternal blood pressure should already be underway. Persistent, severe hypertension places the mother at risk for haemorrhagic stroke, but overcorrection risks compromising placental perfusion. Current ACOG guidelines recommend a target blood pressure range of 140-150/90-100 mmHg [28]. Intravenous hydralazine or labetalol (if available in your country) are first-line antihypertensive medications in this setting.

- Administer non-particulate antacid if surgical delivery is planned.

Intraoperative:

- Type of anaesthesia:

  If timing and the clinical scenario allow, neuraxial anaesthesia offers several advantages compared to general anaesthesia:
  - Greater haemodynamic stability (through avoidance of the hypertensive response to laryngoscopy, and during the maintenance phase of the anaesthetic) [5,29].
  - Avoidance of manipulating a potentially-difficult airway.
  - Improved uteroplacental blood flow and neonatal outcomes [30,31].

  General anaesthesia may be indicated in the setting of eclampsia, altered mental status, pulmonary oedema, or maternal haemorrhage.

- Induction and Maintenance:

  General anaesthesia:
  - Adequate pre-oxygenation to compensate for increased oxygen consumption, reduced functional residual capacity in pregnancy, in the setting of a potentially difficult airway.

  - Re-evaluate airway, as exam may have changed. Consider awake intubation if safe intubation with direct laryngoscopy, videolaryngoscopy, intubating stylets, or other airway tools does not seem to be feasible.

  - If proceeding with asleep intubation, perform a rapid-sequence induction with succinylcholine or a suitable substitute as with any pregnant patient. Use of remifentanil has also been described but may be associated with brief neonatal respiratory depression [32]. Consider avoiding non-depolarising neuromuscular blockade due to potentiation by magnesium sulfate and risk of recurarisation.

  - Antihypertensive treatment to blunt response to laryngoscopy.

  - Maintenance with volatile anaesthesia until delivery. Consider transitioning to propofol infusion or decreased MAC of volatile anaesthetic (approximately 0.5) with additional amnestic agents due to uterine relaxant effects of the volatile agent.

Neuraxial anesthesia:

- Spinal, epidural, and combined spinal-CSE are each potentially safe options. Preference for epidural over spinal due to more gradual development of sympathectomy has not been supported by evidence to date, although the foetal data are limited [4,33].

- Preeclamptic patients may experience less pronounced spinal hypotension and require fewer vasopressors compared with normotensive women [34].

Haemodynamic management: Intraoperatively, invasive haemodynamic monitoring (eg. intra-arterial catheter) may be required in the event of ongoing haemorrhage.

Severe preeclampsia was previously thought to be a low cardiac output state with increased systemic vascular resistance and decreased volume status [35]. Recent TTE data has suggested that in treated severe preeclamptic patients, cardiac output is actually preserved, although diastolic dysfunction is present [36]. Intraoperatively, TTE is increasingly being used to guide haemodynamic management. In the absence of TTE, passive leg raise can be an accurate predictor of fluid responsiveness [37].

Particular or additional monitoring

As above.

Possible complications

Preeclampsia can lead to significant maternal and foetal morbidity. Risks to the foetus include placental abruption, intrauterine growth restriction, non-reassuring foetal testing, and perinatal foetal death, while maternal risks include haemolysis, elevated liver enzymes, low platelets (HELLP syndrome), pulmonary oedema, renal failure, and eclampsia [38].

Preeclampsia leads to post-partum complications as well. In the immediate post-partum period, preeclamptic women have a significantly increased risk of stroke compared to non-pregnant women and women without preeclampsia. In addition, they are at risk for sustained hypertension, and pulmonary oedema. In the long-term, former preeclamptic patients have a higher risk of chronic hypertension, ischaemic heart disease, stroke, venous thromboembolism, type 2 diabetes, renal dysfunction, and all-cause mortality [39].

Rates of neuraxial anaesthetic complications in parturients continue to be low despite their widespread use in preeclamptic patients [2].

Post-operative care

Post-operative analgesia can be attained with neuraxial opioid (e.g., preservative-free morphine) and a scheduled regimen of acetaminophen unless otherwise contraindicated. ACOG recommends avoiding nonsteroidal anti-inflammatory agents due to potential negative effects on blood pressure [13]. Additional pain management strategies include: patient controlled epidural analgesia, transversus abdominis plane blocks, or the sparing use of oral or intravenous opiates if needed.

Blood pressure should continue to be monitored for at least 72 hours following delivery due to the risk of recrudescence of severe hypertension. Vigilance for the development of the complications described above, such as pulmonary oedema and stroke, is also necessary.

Magnesium sulfate therapy typically continues from the intrapartum period to the postpartum period for 24 hours in women with severe preeclampsia to prevent eclampsia.

Disease-related acute problems and effect on anaesthesia and recovery

N/A

Ambulatory anaesthesia

N/A

Obstetrical anaesthesia

N/A

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Date last modified: July 2019

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Disclosure The authors have no financial or other competing interest to disclose. This recommendation was unfunded.

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Disclosure The reviewers have no financial or other competing interest to disclose.