Obstetrics Algorithms in Clinical Practice

Editor
Alok Sharma

Foreword
CN Purandare

JAYPEE

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Chapter 2

Hypertensive Disorders of Pregnancy

Sruthi Bhaskaran, Esha Gupta

INTRODUCTION

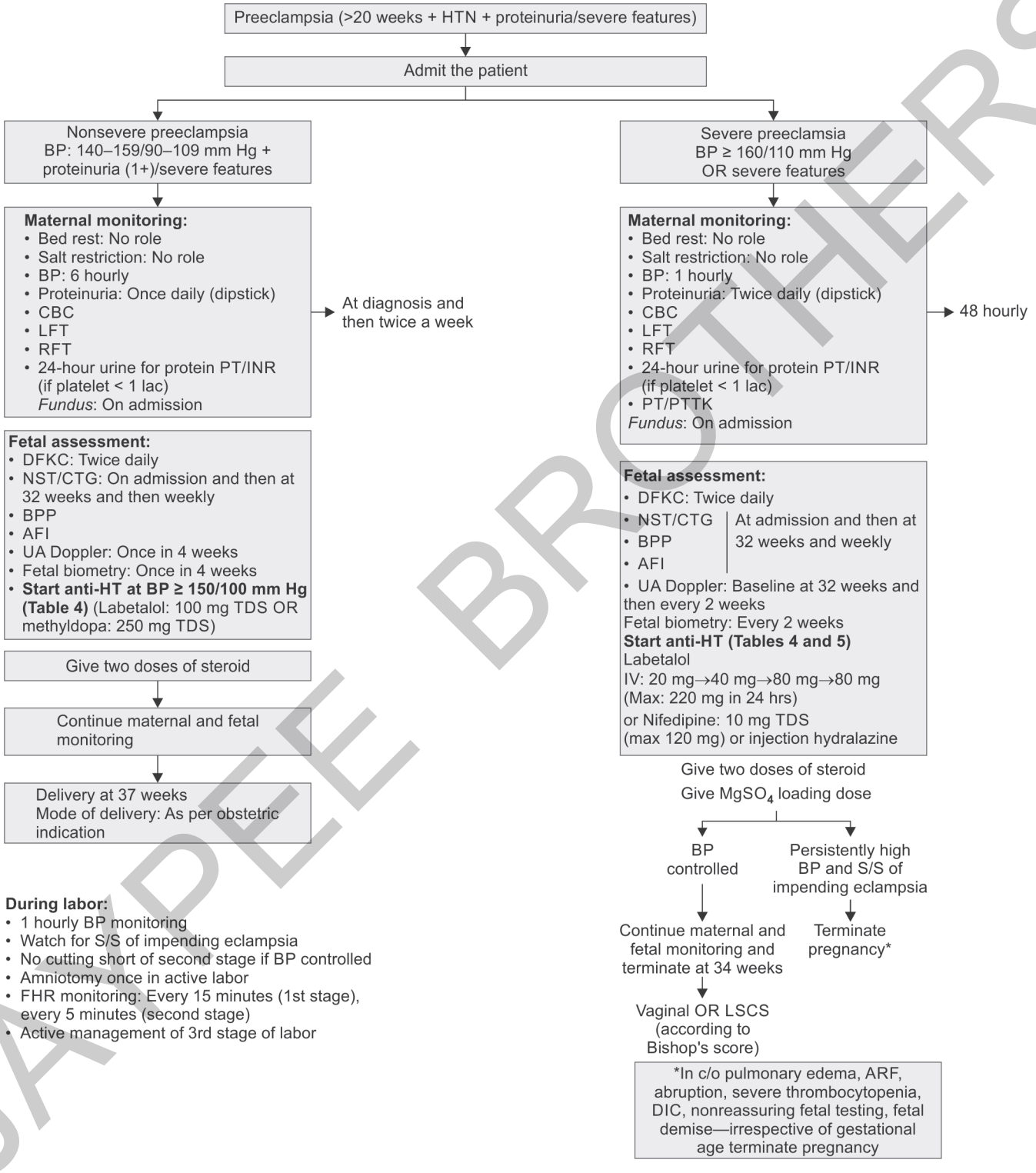
Hypertensive disorders of pregnancy complicate 10–15% of pregnancies worldwide and are an important cause of severe morbidity, long-term disability, and death among both mothers and their babies.[1] Among the hypertensive disorders that complicate pregnancy, preeclampsia and eclampsia stand out as major causes of maternal and perinatal mortality and morbidity.

In this chapter, we have discussed the management protocols of this condition **(Table 1)**.

Table 1: Diagnostic criterion for preeclampsia.[2]

Blood pressure (BP)	• Systolic blood pressure (SBP) ≥ 140 mm Hg or diastolic blood pressure (DBP) ≥ 90 mm Hg on two occasions at least 4 hrs apart after 20 weeks pog with a previously normal BP • Systolic blood pressure of 160 mm Hg or higher, or diastolic blood pressure of 110 mm Hg or higher on two occasions at least 4 hours apart while patient is on bed rest (unless antihypertensive therapy is initiated before this time)
And	
Proteinuria	≥300 mg/24 hr urine collection (or this amount extrapolated from a timed collection Or Pr/cr ratio ≥ 0.3 Dipstick reading of 1+ (used only if other quantitative methods not available)
Or in absence of proteinuria, new-onset hypertension with new-onset severe features of preeclampsia	
Severe features of preeclampsia (any of these findings)	
Thrombocytopenia (platelet count <100,000/μL)	
Impaired liver function tests (≥ twice), severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted by alternative diagnoses, or both	
Progressive renal insufficiency (S. Cr > 1.1 mg/dL or doubling of serum creatinine)	
Concentration in absence of renal disease	
Pulmonary edema	
New-onset cerebral or visual disturbances	

Algorithm 1: Preeclampsia.



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After delivery

- *BP monitoring*: 6 hourly
- *Anti-HT*: Restart if BP ≥ 150/100 mm Hg
- Methyldopa, if already in use should be substituted
- No restriction of angiotensin-converting enzyme (ACE) inhibitors, B-blockers, and dose should be readjusted
- Avoid diuretics during lactation
- *Discharge*: After 72 hours if BP controlled with/without anti-HT
- Follow-up after 1 week and 6 weeks
- *Contraception*: Avoid oral contraceptive pills (OCPs)
- Recurrence risk of preeclampsia: 16% (preeclampsia), 25% [severe preeclampsia, eclampsia, or Hemolysis, elevated liver enzymes and low platelet count syndrome (HELLP)]

(AFI: amniotic fluid index; ARF: acute renal failure; BP: blood pressure; BPP: biophysical profile; CBC: complete blood count; CTG: cardiotocography; DFKC: daily fetal kick count; DIC: disseminated intravascular coagulation; FHR: fetal heart rate; HTN: hypertension; IV: intravenous; LFTs: liver function tests; LSCS: lower segment cesarean section; NST: nonstress test; PT: prothrombin time; RFT: renal function test; TDS: three times daily)

Table 2: Nonsevere preeclampsia (BP: 140–159/90–109 mm Hg + proteinuria (1+)/severe features).

	ACOG (2019)[2]	*NICE (2019)*[3]	*Proposed*
Definition: BP Proteinuria	 140–159/90–109 mm Hg 1+	 Mild: 140–149/90–99 mm Hg Mod: 150–159/100–109 mm Hg 1+	 140–159/90–109 mm Hg 1+
Antenatal monitoring	Home/hospital if: • AFI <5 cm • BPP <6/10 • EBW <5th percentile • PROM	Hospital	Hospital
Salt restriction	No	No	No
Strict bed rest	No	No	No
BP monitoring	Twice weekly	6 hourly	6 hourly
Test for proteinuria	At time of diagnosis	At time of diagnosis	At time of diagnosis and then daily
CBC, LFT, RFT	At time of diagnosis and then once a week	At time of diagnosis and then twice a week	At time of diagnosis and then twice a week
Fundus	At time of diagnosis	–	At time of diagnosis
Fetal monitoring: DFKC by mother	Daily	Daily	Twice daily
NST/CTG BPP	At time of diagnosis and then twice a week Only if NST is nonreactive	At time of diagnosis and then once a week	At time of diagnosis and then fortnightly up to 34 weeks and then weekly
UA doppler	Only if FGR suspected	At time of diagnosis and then every 2 weeks	At time of diagnosis and then fortnightly up to 34 weeks and then weekly (if FGR suspected)
AFI	Once weekly	At time of diagnosis and then every 2 weeks	At time of diagnosis and then fortnightly up to 34 weeks and then weekly
Fetal biometry	Every 3 weeks	At time of diagnosis and then every 2 weeks	At time of diagnosis and then fortnightly up to 34 weeks and then weekly
Anti-HT agents	Not recommended	Start at BP ≥ 150/100 mm Hg	Start at BP ≥ 150/100 mm Hg
Timing of delivery	37 weeks	37 weeks	37 weeks
Mode of delivery	Fetal presentation and cervical status	–	As per obstet indication

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	ACOG (2019)[2]	*NICE (2019)[3]*	*Proposed*
During labor: BP monitoring	Continuous	1 hourly	1 hourly
FHS monitoring	Continuous	Continuous	½ hourly in 1st stage and every 15 min in 2nd stage
Cut short 2nd stage	–	Not recommended	Not recommended
Early amniotomy	–	–	Not recommended
Active management of 3rd stage			Recommended
Postnatal care: • BP monitoring • Anti-HT • Discharge • Follow-up		• 6 hourly while in hospital and then on alternate day for 2 weeks • Continue • When BP is controlled • After 2 weeks	• 6 hourly while in hospital and then daily • Continue • After 72 hrs if BP controlled with or without anti-HT • After 1 week and then at 6 weeks

(ACOG: American College of Obstetricians and Gynecologists; AFI: amniotic fluid index; BP: blood pressure; BPP: biophysical profile; CBC: complete blood count; CTG: cardiotocography; DFKC: daily fetal kick count; EBW: expected body weight; FHS: fetal heart sound; IUGR: intrauterine growth restriction; LFTs: liver function tests; NICE: National Institute of Health and Care Excellence; NST: nonstress test; PROM: premature rupture of membranes; RFT: renal function test; UA: umbilical artery)

Table 3: Severe preeclampsia (BP ≥ 160/110 OR severe features).

	ACOG[2]	*NICE[3]*	*Proposed*
Maternal monitoring	Admit	Admit	Admit
BP monitoring	Every 10 mins × 1 hr, then every 15 mins × 1 hr, then every 30 mins × 1 hr then four times daily	Every 15–30 minutes until BP is less than 160/110 mm Hg, then at least four times daily	Every 15–30 minutes until BP is less than 160/110 mm Hg, then at least four times daily
I/O charting	8 hourly	–	1 hourly
Lab tests (CBC, LFT, RFT, 24 hr urine)	Daily	Three times a week	Alternate day/twice a week
Fundus examination	At the time of diagnosis	–	At the time of diagnosis
Aim: To prolong pregnancy up to	34 weeks	34 weeks	34 weeks
Fetal monitoring: DFKC	Daily	–	Daily
NST/CTG	Daily	Weekly	At admission and then at 32 weeks, then every week
BPP	Twice weekly	–	At admission and then at 32 weeks, then every week
UA Doppler	Every 2 weeks if IUGR is suspected	Every 2 weeks	Baseline at 32 weeks and then every 2 weeks
AFI	Twice weekly	Every 2 weeks	Every week
Fetal biometry	Every 2 weeks	Every 2 weeks	Every 2 weeks
Acute Mx with anti-HT	Labetalol/nifedipine/hydralazine	Labetalol/nifedipine/hydralazine	Labetalol/nifedipine/hydralazine/prazosin
$MgSO_4$ prophylaxis	Yes	Yes	Yes (give loading dose + maintenance if patient delivers)
Timing of delivery Mode of delivery	34 weeks <32 weeks: LSCS >32 weeks: vaginal/LSCS Depending on Bishop score	34 weeks	34 weeks if no complications and BP controlled with anti-HT Vaginal/LSCS depending on Bishop score

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	ACOG[2]	*NICE*[3]	*Proposed*
During labor: BP monitoring	Continuous	Continuous	Hourly
FHR monitoring	Continuous	Continuous	15 minutes in the first stage, every 5 minutes in second stage
Cut short 2nd stage	–	Not recommended	Not recommended If BP controlled
Early amniotomy	No role	No role	Amniotomy once in early active labor
Active management of 3rd stage			Recommended
Postnatal care: BP monitoring		6 hourly while in hospital and then on alternate day for 2 weeks	6 hourly while in hospital and then daily
Anti-HT		Continue	Continue
Discharge		When BP is controlled	After 72 hrs if BP controlled
Follow-up		After 2 weeks	After 1 week

(ACOG: American College of Obstetricians and Gynecologists; AFI: amniotic fluid index; BP: blood pressure; BPP: biophysical profile; CBC: complete blood count; CTG: cardiotocography; DFKC: daily fetal kick count; FHR: fetal heart rate; IUGR: intrauterine growth restriction; LFTs: liver function tests; LSCS: lower segment cesarean section; NICE: National Institute of Health and Care Excellence; NST: non-stress test; RFT: renal function test; UA: umbilical artery)

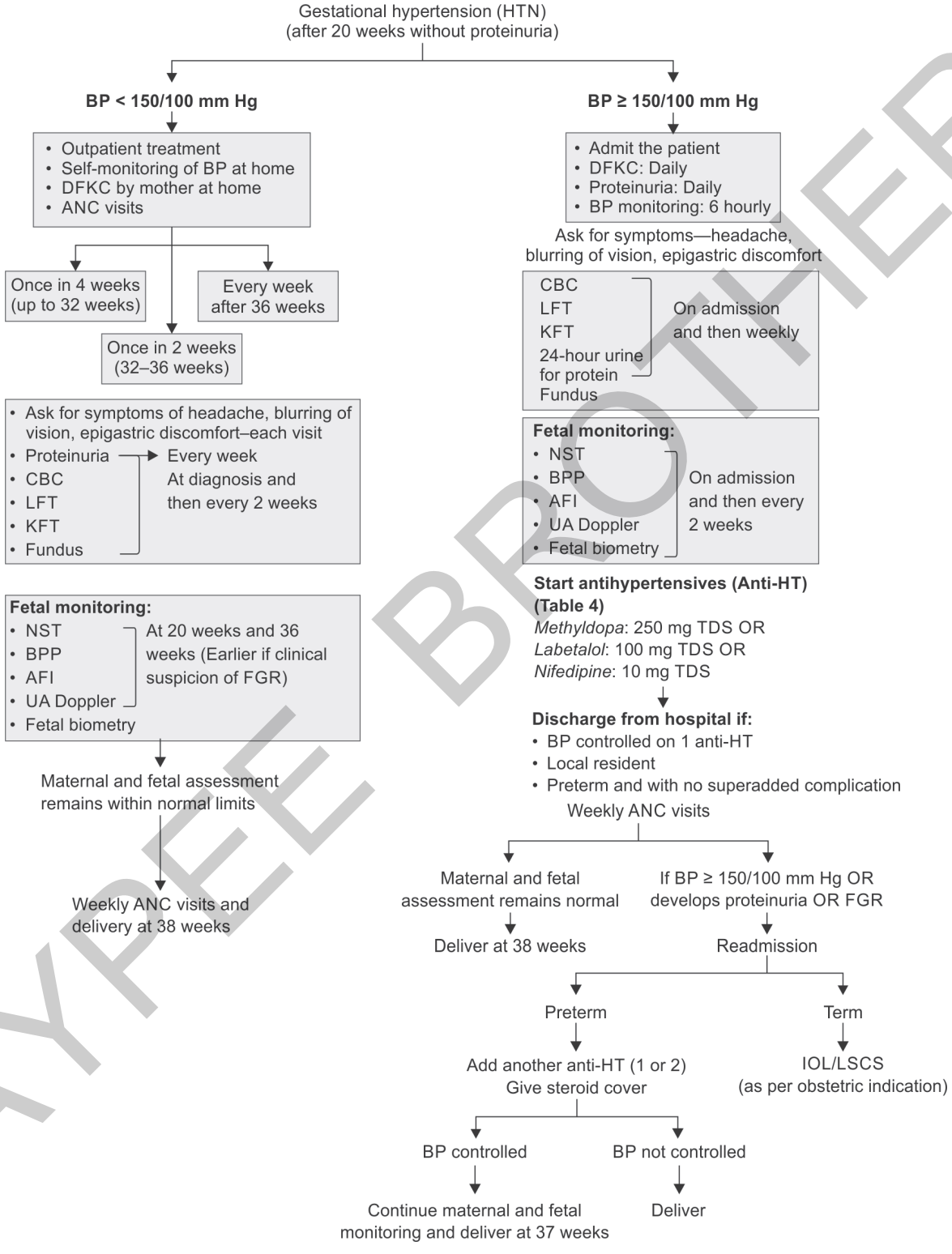
Table 4: Common oral antihypertensive agents in pregnancy.[4]

Drug	*Dosage*	*Comments*
Labetalol	200–2,400 mg/day orally in two to three divided doses. Commonly initiated at 100–200 mg twice daily	• Potential bronchoconstrictive effects • Avoid in women with asthma, pre-existing myocardial disease, decompensated cardiac function, and heart block and bradycardia
Methyldopa	500–3,000 mg/day orally in two to four divided doses. Commonly initiated at 250 mg twice or three times daily	May not be as effective as other medications, especially in control of severe hypertension. Use limited by side effect profile (sedation, depression, dizziness)
Nifedipine	30–120 mg/day orally of an extended-release preparation. Commonly initiated at 30–60 mg once daily (extended-release)	• Do not use sublingual form • Immediate-release formulation should generally be reserved for control of severe, acutely elevated blood pressures in hospitalized patients. Should be avoided in tachycardia

Table 5: Antihypertensive agents used for urgent blood pressure control in pregnancy.[4]

Drug	*Dosage*	*Comments*	*Onset of action*
Labetalol	10–20 mg IV, then 20–80 mg every 10–30 minutes to a maximum cumulative dosage of 300 mg; or constant infusion 1–2 mg/min IV	• Tachycardia is less common and fewer adverse effects than other agents • Avoid in women with asthma, pre-existing myocardial disease, decompensated cardiac function, and heart block and bradycardia	1–2 minutes
Hydralazine	5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr	Maternal hypotension, headaches, and abnormal fetal heart rate tracings; may be more common than other agents	10–20 minutes
Nifedipine	10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg	May observe reflex tachycardia and headaches.	5–10 minutes

Algorithm 2: Gestational hypertension.



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During labor

- 1 hourly BP monitoring
- No cutting short of second stage if BP controlled
- No early amniotomy
- *FHR monitoring*:
  - ½ hourly (1st stage)
  - 15 minutes (2nd stage)
- Active management of 3rd stage of labor

After delivery

- *BP monitoring*: Once daily
- *Anti-HT*: May not be required
  - Restart if BP ≥ 150/100 mm Hg after 24 hrs
  - Methyldopa should not be used
- No restriction of ACE inhibitors, B-blockers, and dose should be readjusted
- Avoid diuretics during lactation
- *Discharged*: After 72 hours if BP controlled or patient is on anti-HT treatment
- FU after 1 week and 6 weeks
- *Recurrence risk*:
  - Gestational HTN: 16–47%
  - Preeclampsia: 2–7%

(AFI: amniotic fluid index; ANC: antenatal care; BP: blood pressure; BPP: biophysical profile; CBC: complete blood count; DFKC: daily fetal kick count; FGR: fetal growth restriction; IOL: induction of labor; KFT: kidney function test; LFTs: liver function tests; LSCS: lower segment cesarean section; NST: nonstress test; RFT: renal function test; UA: umbilical artery)

ECLAMPSIA

Admit the patient.
History from attendant: Duration of pregnancy, number of fits, history of epilepsy, history of fits or HTN in previous pregnancy, drug therapy.
Call for help.

↓

- **Avoid maternal injury**: Railed cot
- **Maintain**: Airway—Left lateral position, suction of secretions, padded tongue blade
  Breathing: Oxygen by mask (6–8 L/min)
  Circulation: Evaluate PR and BP
- **Examination: GPE**—Conscious/unconscious
  PR/BP/RR/PE
  B/L chest: Clear/crepts
- **Make IV lines patent** (No. 18 Cannula)
- Sample should be sent for CBC, LFT, RFT, and cross-match

Fluids: Not > 80 mL/hr OR 2 l/24 hrs
Crystalloids (RL, NS) preferred over colloids (Haemaccel, albumin, dextran)

↓

- **Do P/A**: Abdominal wall edema
  Fundal height, liquor, contractions
  FHR auscultation
- **Do Foley's catheterization**
- **Do P/V:** Dilatation, cervical status, memb, Bishop

↓

Give $MgSO_4$ loading f/b maintenance

Pritchard regime (IM)
4 g (20%) of $MgSO_4$ IV bolus over 10–15 min f/b 10 g (50%) deep IM (5 g in each buttock) f/b maintenance; 5 g IM in alternate buttock 4 hourly till 24 hrs of delivery or last seizure whichever occurred later

Zuspan regime (IV)
4–6 g of $MgSO_4$ diluted in 100 mL of NS over 15–20 min f/b maintenance dose of 1 g/hr IV infusion till 24 hrs of delivery or last seizure whichever occurred later (5 g $MgSO_4$ in 500 mL of NS at the rate of 22 d/min, i.e. 1 g/hr)

If seizure reoccurs: Give 2 g of $MgSO_4$ bolus over 5 min OR Increase the rate of infusion to 1.5–2 g/hr

↓

Seizure reoccurs: Give phenobarbitone 300 mg IV over 5 min
Monitor for Mg toxicity: Look for

- Respiratory rate (>12 breaths/min)
- Deep tendon reflexes (+)
- Urine output (>30 mL/hr)

↓

If toxicity occurs: Stop $MgSO_4$
Give Ca gluconate 1 g (10 mL) of 10% over 10 min IV (if there is respiratory depression)
NO DIURETICS if urine output decreased.

↓

Start phenytoin (prior ECG should be done), loading dose: 10–15 mg/kg at the rate of 50 mg/min (600 mg in 300 mL NS over ½ hr f/b 300 mg in 200 mL NS over ½ hr f/b), maintenance dose of 100 mg IV 8 hourly

- **Start anti-HT:** Labetalol 20 mg IV stat → 40 mg IV → 80 mg IV → 80 mg IV every 20 min if BP not controlled. Max dose being 220 mg/24 hrs. Once BP is controlled and patient is conscious start oral labetalol 200 mg TDS.

During P/V exam:
Pt in labor
↓
DO ARM
OXYTOCIN if require
↓
DELIVER

Pt not in labor
↓
Term → INDUCTION according to Bishop's score
Preterm
Consent, expl risk of prematurity, steroid cover
↓
INDUCTION according to Bishop's score
↓
Bishop ≥ 6: ARM + oxytocin
Bishop < 6: Misoprost (25 µg) or Dinoprostone gel
↓
Bishop reassess after 4 hrs / Bishop reassess after 6 hrs
↓
Favorable: Oxytocin-Deliver
Unfavorable: LSCS

Contd...

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During delivery

- Bed delivery
- *Cut short 2nd stage of labor*: Forceps/ventouse
- Active management of 3rd stage
- Be vigilant for PPH

After delivery

- Continue $MgSO_4$ maintenance
- *BP monitoring*: Hourly for 24 hrs and then 6 hourly if controlled
- I/O charting 6 hourly
- Restart anti-HT after 24 hrs if BP ≥ 150/100 mm Hg (labetalol/atenolol/nifedipine) with readjusted dose
- Patient to be discharged after 1 week if no complication
- FU after 1 week

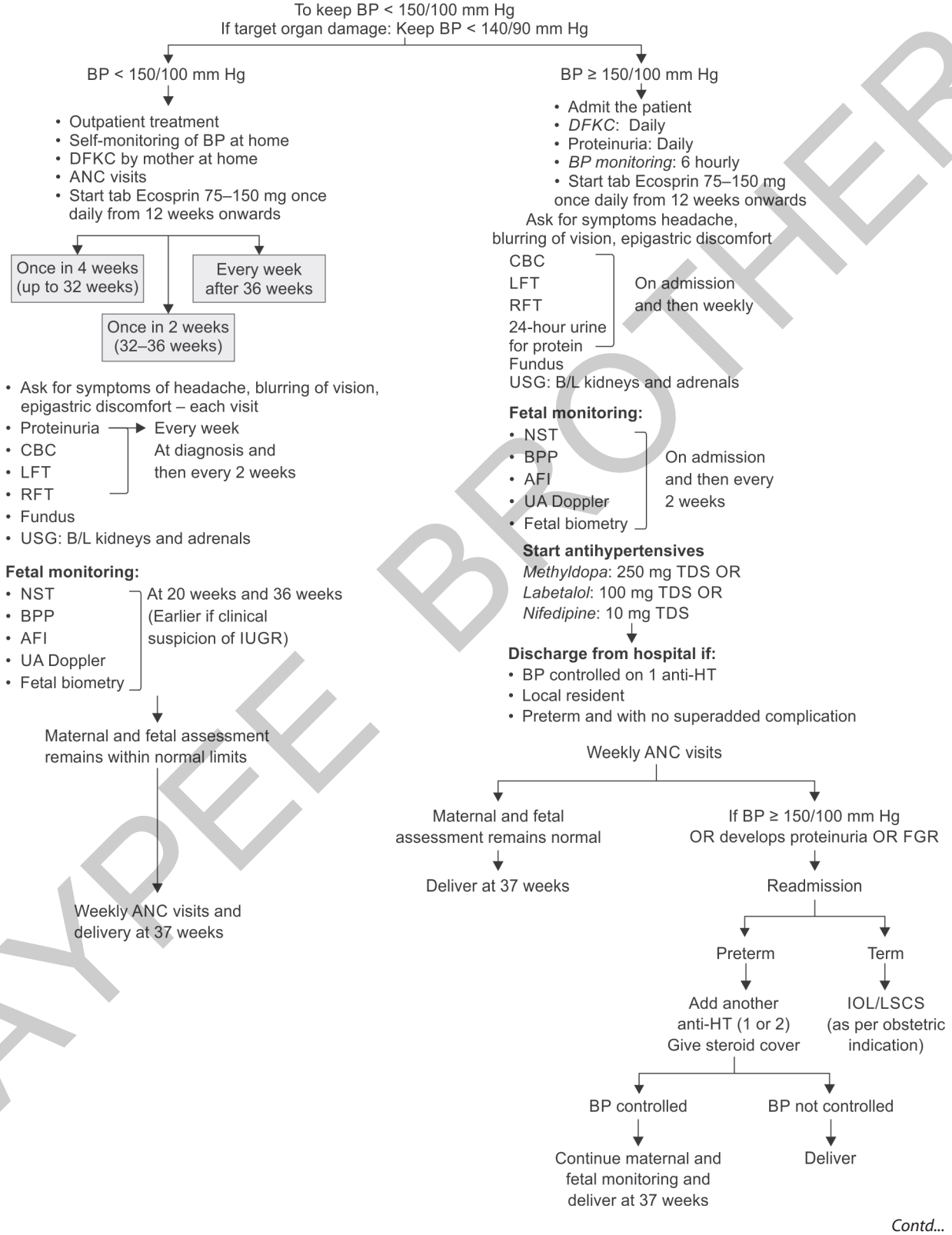
(ARM: artificial rupture of membranes; BP: blood pressure; FHR: fetal heart rate; GPE: general physical examination; HTN: hypertension; IM: intramuscular; IV: intravenous; LSCS: lower segment cesarean section; NS: normal saline; PE: preeclampsia; PR: pulse rate; RFT: renal function test; RL: Ringer's lactate)

CHRONIC HYPERTENSION (BEFORE CONCEPTION OR BEFORE 20 WEEKS WITHOUT PROTEINURIA)[4]

Preconceptional Counseling

- Explain risks associated with chronic HTN and superimposed preeclampsia
- Stop ACE inhibitors, ARB, mineralocorticoid antagonists
- Tests: CBC, platelet count, LFT, KFT, serum electrolytes, and TSH; Urine for protein (dipstick, 24 hr protein), urine c/s; fundus examination; USG: B/L kidneys and adrenals

Aim



Contd...

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During labor

- 1 hourly BP monitoring
- No cutting short of second stage if BP controlled
- No early amniotomy
- *FHR monitoring*:
  - ½ hourly (1st stage)
  - 15 minutes (2nd stage)
- Active management of 3rd stage of labor.

After delivery

- *BP monitoring*: Once daily
- *Continue anti-HT*: Methyldopa should not be used
- No restriction of ACE inhibitors, B-blockers, and dose should be readjusted
- Avoid diuretics during lactation
- *Discharged*: After 72 hours if BP is controlled or patient is on anti-HT treatment.
- FU after 1 week and 6 weeks.

(AFI: amniotic fluid index; ANC: antenatal care; BP: blood pressure; BPP: biophysical profile; CBC: complete blood count; DFKC: daily fetal kick count; FHR: fetal heart restriction; IOL: induction of labor; IUGR: intrauterine growth restriction; LFT: liver function test; LSCS: lower segment cesarean section; NST: nonstress test; RFT: renal function test; USG: ultrasonography; UA: umbilical artery)

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Obstetrics Algorithms in Clinical Practice

Key Features

- Provides an overview of treatment protocols and outcomes in the field of Obstetrics by a unique algorithmic approach
- Designed to support rapid decision making in the most clinically relevant situations to minimize the risks of a poor outcome
- Based on current national guidelines and clinical evidence, the algorithms can be used as a reliable and practical resource for normal and problem cases encountered in day-to-day practice
- Divided into various sections like maternal disorders, antenatal emergencies, labor, delivery, and postpartum period
- Each chapter is presented as an algorithm and has been carefully structured to ensure a logical progression of thought to aid anticipation, early diagnosis, and prompt and appropriate management
- Used easy-to-follow management algorithms presented in a highly visual format
- A ready reckoner for the obstetricians, postgraduate students, and private practitioners who are practicing obstetrics and gynecology.

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