2025 ESC Guidelines for the management of cardiovascular disease and pregnancy

Official Slide Set

2025 ESC Guidelines for the management of cardiovascular disease and pregnancy
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf193)

ESC Guidelines for the management of CVD and pregnancy

The material was adapted from the *'2025 ESC Guidelines for the management of cardiovascular disease and pregnancy. Endorsed by the European Society of Gynecology (ESG).'* (*European Heart Journal*; 2025 - doi: 10.1093/eurheartj/ehaf193 as published on 29/08/25.

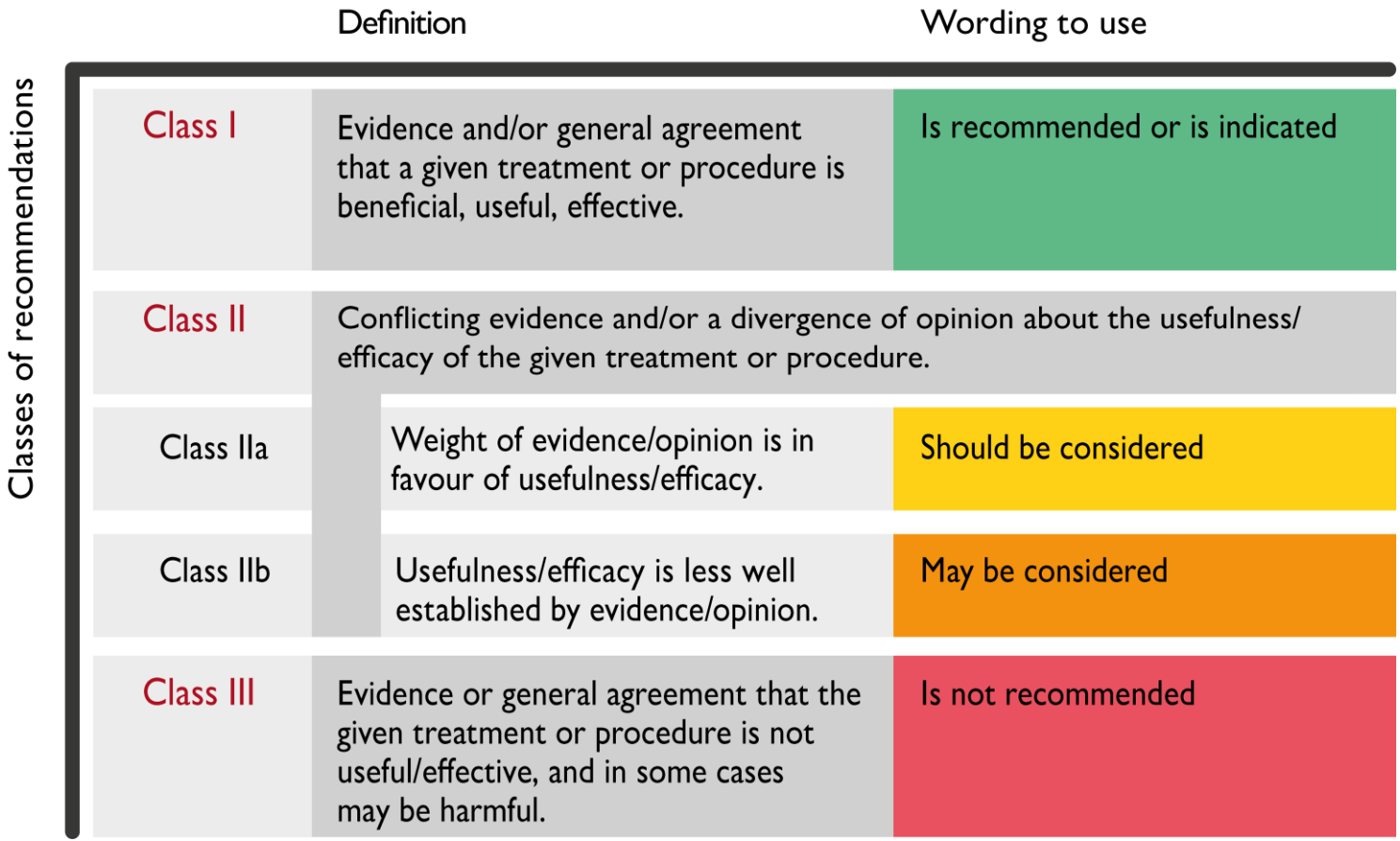
ESC Guidelines for the management of CVD and pregnancy

Authors/Task Force Members:

Julie De Backer (Task Force Chairperson) (Belgium), Kristina H. Haugaa (Task Force Chairperson) (Norway), Nina Eide Hasselberg (Task Force Coordinator) (Norway), Michèle de Hosson (Task Force Coordinator) (Belgium), Margarita Brida (Croatia), Silvia Castelletti (Italy), Matthew Cauldwell (United Kingdom) Elisabetta Cerbai (Italy), Lia Crotti (Italy), Natasja M.S. de Groot (Netherlands), Mette-Elise Estensen (Norway), Eva S Goossens (Belgium), Bernhard Haring (Germany), Donata Kurpas (Poland), Carmel M McEniery (United Kingdom), Sanne A.E. Peters (Netherlands), Amina Rakisheva (Kazakhstan), Antonia Sambola (Spain), Oliver Schlager (Austria), Florian S. Schoenhoff (Switzerland), Tommaso Simoncini[1] (Italy), Françoise Steinbach (France), Isabella Sudano (Switzerland), Lorna Swan (United Kingdom), Anne Marie Valente (United States of America)

[1]Representing the European Society of Gynecology (ESG)

ESC Classes of recommendations



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ESC Levels of evidence

Level of evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of evidence C	Consensus of opinion of the experts and/or small studies, retrospective studies, registries.

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Updates of the 2025 Guidelines on CVD and pregnancy

Topic	New information	Rationale
Pregnancy Heart Team	Broader acceptance, dedicated section	Ensure comprehensive care throughout reproductive stages
Risk stratification	mWHO 2.0 classification, refined and expanded clinical categories	More data have emerged, necessitating more nuanced risk assessment for patient counselling
Clinical data and research	ROPAC and PPCM registries Cardiomyopathies Primary arrhythmia syndromes	New or updated clinical management
Clinical scenarios	Algorithms for management of clinical situations in pregnant women	Provide practical information for the clinical cardiologist
Genetic testing and counselling	Advancements in testing and pre-implantation procedures	Incorporation of latest management of genetic testing and counselling
Revision of contraindications (COR III) for pregnancy in women classified as mWHO class IV	Emphasis on the critical role of comprehensive counselling by the Pregnancy Heart Team (COR I)	Recognition of a woman's autonomy in making reproductive choices Promoting a detailed and transparent dialogue about the heightened risks and encouraging shared decision-making
Adverse pregnancy outcomes (APO)	Increased focus on long-term outcomes	Evidence supports the need for thorough discussion and management of APOs

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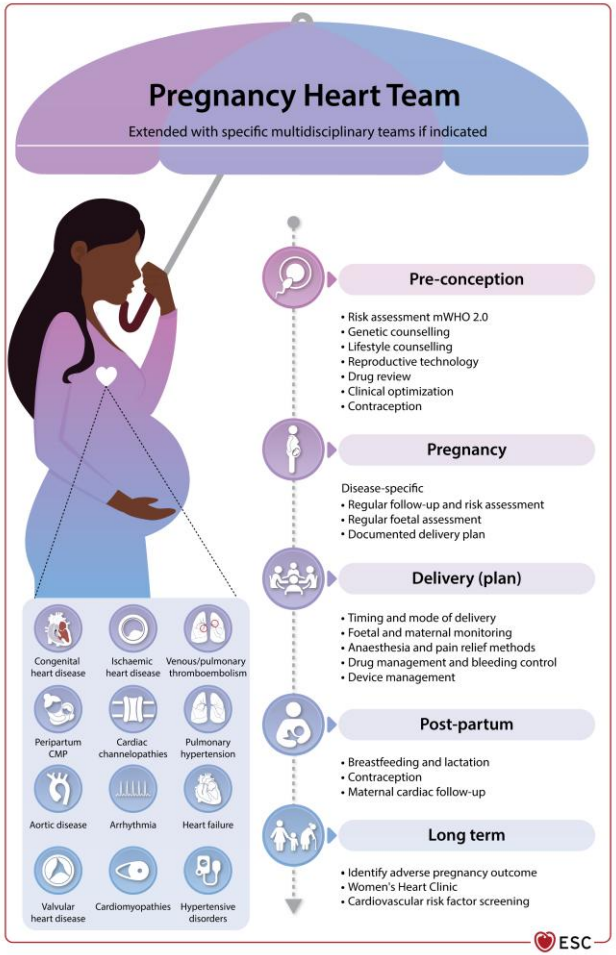
Figure 1

Central illustration. Role of Pregnancy Heart Team in pregnancy pathway



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New recommendations (1)

Recommendations	Class	Level
Section 4. The Pregnancy Heart Team		
Although the concept of the Pregnancy Heart Team was previously part of the general principles, it has now been given its own dedicated section, which covers all aspects from pre-conception through to the postpartum period.		
A discussion by the Pregnancy Heart Team about the high risk of maternal mortality or morbidity and the related high foetal risk is recommended for women with mWHO 2.0 class IV conditions, including a shared decision-making process for pregnancy termination, involving psychological support.	I	C
It is recommended that women with CVD of mWHO 2.0 class II–III and above are evaluated and managed by a Pregnancy Heart Team from pre-pregnancy onwards through pregnancy and post-partum.	I	C
Measurement of BNP and NT-proBNP levels should be considered prior to pregnancy in women with HF of any aetiology, including previous PPCM, cardiomyopathy, ACHD, and PAH, and be monitored during pregnancy according to the underlying disorder and in case of new-onset or worsening symptoms.	IIa	B

New recommendations (2)

Recommendations	Class	Level
Section 5. Drugs during pregnancy and lactation		
Given the importance of medication use throughout this document, this section has been brought forward and revised.		
Section 6. Pregnancy in women with cardiomyopathies and primary arrhythmia syndromes		
This section has been expanded since 2018 for advice in specific cardiomyopathies and primary arrhythmias.		
Vaginal delivery is recommended in most women with CMPs, unless there are obstetric indications for caesarean section, severe HF (EF <30% and/or NYHA class III/IV), uncontrolled arrhythmias, or severe outflow obstruction (≥50 mmHg) in women with HCM, or in women presenting in labour on VKAs.	**I**	**C**
In women with DCM and worsening of EF during pregnancy, counselling on the risk of recurrence during a subsequent pregnancy is recommended in all cases, even after recovery of LV function.	**I**	**C**

New recommendations (3)

Recommendations	Class	Level
Section 6. Pregnancy in women with cardiomyopathies and primary arrhythmia syndromes cont.		
It is recommended that women with HCM with symptomatic LV dysfunction (EF <50%) and or severe LVOTO (≥50 mmHg) wishing to become pregnant are counselled by the Pregnancy Heart Team regarding the high risk of pregnancy-related adverse events.	I	C
Myosin inhibitors are not recommended in women during pregnancy due to lack of safety data.	III	C
Beta-blockers, with pre-pregnancy dose and with nadolol and propranolol as drugs of choice, are recommended during pregnancy in women with LQTS.	I	B
It is recommended to continue beta-blocker therapy during lactation in women with LQTS to reduce arrhythmic risk.	I	B
Pre-pregnancy dose beta-blockers with nadolol or propranolol is recommended in patients with LQT2, particularly in the post-partum period, which represents a high-risk period for life-threatening arrhythmias.	I	B
Beta-blockers, with pre-pregnancy dose and with nadolol and propranolol as drugs of choice, are recommended during pregnancy and lactation in women with CPVT.	I	C

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New recommendations (4)

Recommendations	Class	Level
Section 6. Pregnancy in women with cardiomyopathies and primary arrhythmia syndromes cont.		
Flecainide, in addition to beta-blockers, is recommended in women with CPVT who experience cardiac events, such as syncope, VT, or cardiac arrest during pregnancy.	I	C
Section 7. Peripartum cardiomyopathy		
We have provided a separate section on PPCM in these guidelines.		
Genetic counselling and testing should be considered in women with PPCM.	IIa	C
When a reversible course of HF is assumed, treatment in accordance with HF guidelines should be considered for at least 12 months after complete LV recovery (normalization of LV volumes and EF).	IIa	C
Section 8. Pregnancy in women with aortopathies		
Since 2018, significant evidence has emerged in the context of heritable thoracic aortic disease (HTAD), supporting a more gene- and variant-based approach, which has been incorporated in this version of the guidelines.		
It is recommended that women with a history of dissection or aortic surgery have pre-pregnancy counselling about the high risk by an extended Pregnancy Heart Team considering the presence and type of genetic variant, aortic morphology, growth rate, and aetiology of aortic dissection.	I	C

New recommendations (5)

Recommendations	Class	Level
Section 9. Pregnancy in women with known congenital heart disease		
This section has undergone a major update based on recent reports, which have been summarized in a clear and concise table.		
It is recommended that all women with Fontan circulation who wish to become pregnant receive counselling from the Pregnancy Heart Team regarding the high risk of pregnancy-related adverse events.	**I**	**C**
Section 10. Pregnancy in women with pulmonary arterial hypertension		
This subject is now covered in a separate section in these guidelines, in line with growing insights into management.		
It is recommended that women of childbearing potential with PAH wishing to become pregnant are counselled by a multidisciplinary team regarding the very high risk of pregnancy-related adverse events, encouraging a shared decision-making process about whether to become pregnant.	**I**	**C**

New recommendations (6)

Recommendations	Class	Level
Section 11. Venous thromboembolism in pregnancy and post-partum		
Guidance on the involvement of an expert team and a more prompt initiation of treatment are now provided in dedicated flowcharts and recommendations.		
In pregnant women or women in the post-partum period with suspicion of venous thromboembolism (VTE) (deep vein thrombosis [DVT] and/or PE), an immediate formal diagnostic assessment with validated methods is recommended and should not be postponed.	**I**	**B**
Section 12. Pregnancy in women with acquired heart disease		
Recommendations for emergency situations are provided for acquired heart diseases in addition to the new sections on cardio-oncology and heart transplantation.		
Recommendations for coronary artery disease and pregnancy		
In pregnant women with chest pain, it is recommended to exclude life-threatening cardiovascular conditions, including PE, ACS (including SCAD), and acute aortic syndrome.	**I**	**C**
The duration of DAPT (aspirin and clopidogrel) in pregnant women undergoing coronary stent implantation is recommended to be the same as in non-pregnant women, with an individual approach considering ischaemic risk and delivery-related bleeding risks.	**I**	**C**
Continuation of statins may be considered during pregnancy in women with established ASCVD.	**IIb**	**C**

New recommendations (7)

Recommendations	Class	Level
Section 12. Pregnancy in women with acquired heart disease cont.		
Recommendations for hypertensive disorders and pregnancy		
It is recommended to aim for systolic BP <140 mmHg and diastolic BP <90 mmHg in pregnant women.	I	B
In severe hypertension, drug treatment with i.v. labetalol, urapidil, nicardipine, or oral short acting nifedipine or methyldopa is recommended for acute reduction in blood pressure. I.v. hydralazine is a second-line option.	I	C
Recommendations for supraventricular tachycardia and pregnancy		
Therapeutic anticoagulation with LMWH is recommended for pregnant women with persistent or permanent AF at elevated thromboembolic risk.	I	C
Flecainide, in addition to beta-blockers, should be considered for long-term AF rhythm control in pregnancy.	IIa	C
Recommendation for ventricular tachycardia, device implantation, catheter ablation and pregnancy		
When performing catheter ablation during pregnancy, the use of non-fluoroscopic mapping and navigation systems should be considered.	IIa	C

New recommendations (8)

Recommendations	Class	Level
Section 12. Pregnancy in women with acquired heart disease cont.		
Recommendations for cardiac arrest and pregnancy		
Continuous manual left uterine displacement during CPR in pregnant women (≥20 weeks) with cardiac arrest is recommended to relieve aortocaval compression.	I	C
It is recommended to establish i.v. access above the diaphragm to ensure that the i.v. therapy is not obstructed by the gravid uterus.	I	C
It is recommended that no drugs are withheld in pregnant women with cardiac arrest due to concerns of teratogenicity.	I	C
Recommendation for congenital atrioventricular block and pregnancy		
In pregnant women with asymptomatic congenital AV block, normal cardiac anatomy and function, a narrow QRS complex, and ventricular rate (≥50 b.p.m.) a prophylactic temporary pacemaker during delivery is not recommended.	III	C
Recommendation for native valve disease and pregnancy		
Valve surgery during pregnancy should only be considered when there is a maternal mortality risk and other treatment options have failed.	IIa	C

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New recommendations (9)

Recommendations	Class	Level
Section 12. Pregnancy in women with acquired heart disease cont.		
Recommendation for prosthetic valves disease and pregnancy		
It is recommended that a care plan documenting the agreed anticoagulant strategy (including the decision to continue VKAs or converting to therapeutic-dose LMWH in the first trimester) is in place for women of childbearing age with a MHV prior to pregnancy or as soon as pregnancy is recognized.	I	C
Recommendations for chronic and acute heart failure and pregnancy		
Inotropes and/or vasopressors are recommended in pregnant women with cardiogenic shock with levosimendan, dobutamine, and milrinone as recommended agents.	I	C
ACE-Is, ARBs, ARNIs, MRAs, ivabradine, and SGLT2 inhibitors are not recommended during pregnancy due to adverse foetal effects.	III	C
Recommendations for heart transplantation and pregnancy		
It is recommended to postpone pregnancy until at least 1 year after heart transplantation, taking individual risk factors into account.	I	C
In women with a heart transplant, it is recommended that immunosuppression serum drug levels are monitored during pregnancy every 4 weeks until the 32nd week, then every 2 weeks until the 36th week, then weekly until delivery and for 6–12 months after delivery to guide dosing.	I	C

New recommendations (10)

Recommendations	Class	Level
Section 12. Pregnancy in women with acquired heart disease cont.		
Recommendations for cardio-oncology and pregnancy		
It is recommended that pregnant women with cancer who require cardiotoxic cancer therapy are jointly managed by the Pregnancy Heart Team and the cardio-oncology team.	I	C
Section 13. Long-term effects of adverse pregnancy outcomes		
This is a completely new section in the guidelines, reflecting the growing recognition of the importance of APOs.		
It is recommended to undertake a cardiovascular risk assessment in women with APOs, to recognize and document APOs when CVD risk is evaluated in women, and to provide counselling on the importance of healthy lifestyle choices that optimize cardiovascular health.	I	B

Revised recommendations (1)

2018 Guidelines	Class	Level	2025 Guidelines	Class	Level
Section 4. The Pregnancy Heart Team					
Prophylactic antibiotic therapy to prevent endocarditis during delivery is not recommended.	**III**	**C**	Systemic antibiotic prophylaxis may be considered for delivery in women at high risk.	**IIb**	**C**
Section 6. Recommendations for cardiomyopathies and pregnancy					
In patients with HCM, it is recommended that beta-blockers are continued in women who used them before pregnancy.	**I**	**C**	Continuation of beta-blockers should be considered during pregnancy in women with CMPs, with close follow-up of foetal growth.	**IIa**	**C**

Revised recommendations (2)

2018 Guidelines	Class	Level	2025 Guidelines	Class	Level
Section 8. Recommendations for aortopathies, cardiac surgery, and pregnancy					
Pregnancy is not recommended in patients with vascular Ehlers–Danlos syndrome.	III	C	It is recommended that women with vascular Ehlers–Danlos syndrome wishing to become pregnant are counselled regarding the very high risk of pregnancy-related adverse events by a multidisciplinary team, considering family history, genetic variant, and previous vascular events.	I	C
Beta-blocker therapy throughout pregnancy should be considered in women with Marfan syndrome and other heritable thoracic aortic diseases.	IIa	C	Beta-blocker therapy throughout pregnancy and in the post-partum period is recommended in women with MFS and other HTADs.	I	C

Revised recommendations (3)

2018 Guidelines	Class	Level	2025 Guidelines	Class	Level
Section 9. Recommendations for congenital heart disease and pregnancy					
Patients with a systemic right ventricle (Mustard/Senning or congenitally corrected TGA), in NYHA class III/IV, systemic ventricular dysfunction (EF <40%), or severe TR should be advised against pregnancy.	**IIa**	**C**	It is recommended that women with a systemic RV (Mustard/Senning or congenitally corrected TGA), in NYHA class III/IV, systemic ventricular dysfunction (EF <40%), or severe TR wishing to become pregnant are counselled by the Pregnancy Heart Team regarding the high risk of pregnancy-related adverse events.	**I**	**C**
Section 12. Recommendations for acquired heart disease and pregnancy					
An invasive management strategy should be considered for NSTE ACS with high-risk criteria.	**IIa**	**C**	It is recommended to manage pregnant women with ACS in the same way as non-pregnant women, including diagnostic investigations and interventions.	**I**	**C**

Revised recommendations (4)

2018 Guidelines	Class	Level	2025 Guidelines	Class	Level
Section 12. Recommendations for acquired heart disease and pregnancy cont.					
Catheter ablation with electro-anatomical systems should be considered in experienced centres in cases of drug-refractory and poorly tolerated SVT.	**IIa**	**C**	Catheter ablation may be considered in pregnant women with recurrent, long symptomatic SVT or with contraindications to pharmacological therapies.	**IIb**	**C**
Balloon aortic valvuloplasty should be considered during pregnancy in patients with severe aortic stenosis and severe symptoms.	**IIa**	**C**	In very selected symptomatic pregnant women with severe aortic stenosis not responding to medical therapy, non-surgical options such as balloon valvuloplasty or TAVI may be considered.	**IIb**	**C**
A bioprosthesis should be considered in young women contemplating pregnancy.	**IIa**	**C**	A bioprosthetic valve is recommended (over a mechanical valve) in young women contemplating pregnancy requiring a valve prosthesis.	**I**	**B**

Revised recommendations (5)

2018 Guidelines	Class	Level	2025 Guidelines	Class	Level
Section 12. Recommendations for acquired heart disease and pregnancy cont.					
During the second and third trimesters, LMWH with anti-factor Xa level monitoring and dose adjustment (see separate recommendations) may be considered in women who need a high dose of VKA after patient information and consent.	**IIb**	**C**	During the second and third trimesters until the 36th week, continuing VKAs should be considered in women with prosthetic heart valves at higher risk of thrombosis.	**IIa**	**C**

Figure 2

Physiology of haemodynamic changes and changes in electrocardiogram and echocardiography during and post pregnancy

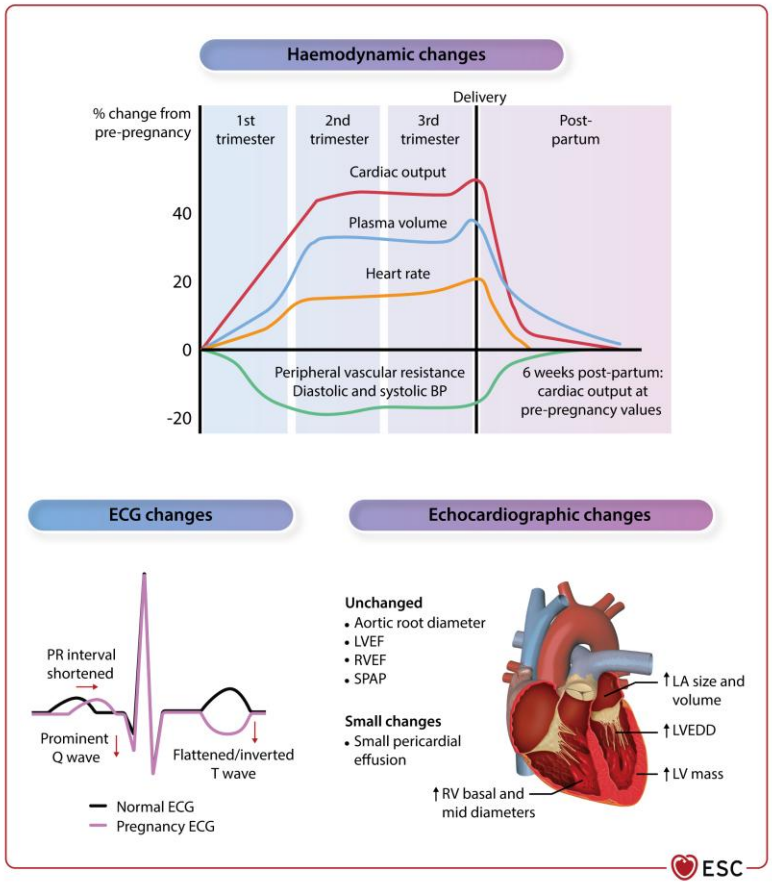

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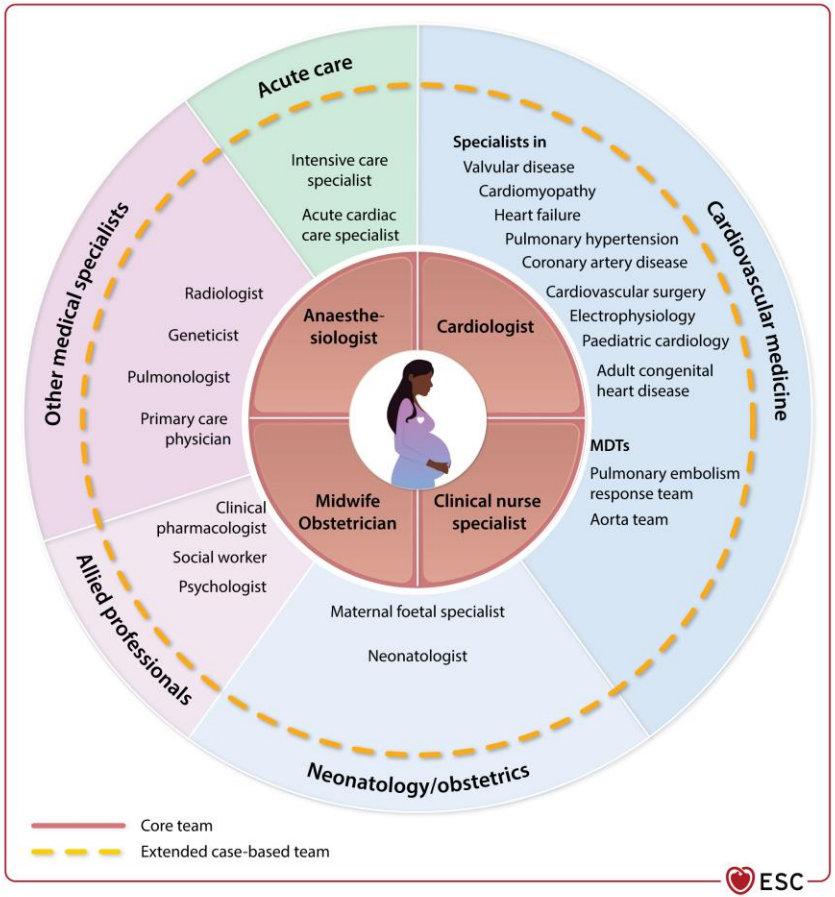
Figure 3

Composition of the core and expanded case-based Pregnancy Heart Team



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Modified WHO 2.0 classification of maternal CV risk (1)

mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
Ventricular (dys)function + pulmonary hypertension				
		Mild left ventricular impairment: EF >45% Significantly impaired RV (sub-pulmonary) function	Moderate left ventricular impairment: EF 30%–45% Previous PPCM with not more than mild residual left ventricular impairment	Severe left ventricular impairment: EF <30% or NYHA class III/IV Previous PPCM with more than mild left ventricular impairment PAH
Arrhythmias				
Atrial or ventricular ectopic beats, isolated	Most supraventricular arrhythmias Bradycardia requiring pacemaker	Low-risk LQTS: no previous events + on full dose beta-blocker therapy Low-risk CPVT: well controlled by medical therapy BrS with no previous events	Sustained ventricular tachycardia from any aetiology LQT2 (post-partum) Symptomatic CPVT and LQTS not adequately controlled by therapy BrS with previous events	

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Modified WHO 2.0 classification of maternal CV risk (2)

mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
Cardiomyopathy				
HCM: genotype-positive + phenotype-negative		Low-risk ARVC: genotype-positive + no or mild phenotype HCM without complications DCM/NDLVC with normal or mild left ventricular impairment: EF >45%	ARVC with moderate/severe disease HCM with arrhythmic and/or moderate haemodynamic complications DCM/NDLVC with moderate left ventricular impairment: EF 30%–45%	DCM/NDLVC with severe left ventricular impairment: EF <30% or NYHA class III/IV HCM with symptomatic severe outflow tract obstruction: ≥50 mmHg HCM with severely symptomatic LV dysfunction (EF <50%)
Valvular heart disease				
Small or mild pulmonary stenosis mitral valve prolapse without significant regurgitation		Native, homograft or tissue valve disease not considered mWHO 2.0 I or IV: mild mitral stenosis, moderate aortic stenosis Moderate valvular regurgitation	Uncomplicated mechanical valve with stable well controlled INRs. Moderate mitral stenosis Severe asymptomatic aortic stenosis Severe left-sided valvular regurgitation	Severe mitral stenosis Severe symptomatic aortic stenosis

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Modified WHO 2.0 classification of maternal CV risk (3)

mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
Congenital heart disease				
Successfully repaired simple lesions without significant residual (haemodynamic) complications (atrial or ventricular septal defect, patent ductus arteriosus, anomalous pulmonary venous drainage)	Unoperated uncomplicated atrial or ventricular septal defect Repaired tetralogy of Fallot without significant residual haemodynamic/ arrhythmic lesions Transposition of the great arteries with arterial switch without significant residual lesions	Repaired atrioventricular septal defect without significant residual lesions Uncomplicated Ebstein anomaly: mild to moderate TR, no tricuspid stenosis, no accessory pathway	Unrepaired cyanotic heart disease (not Eisenmenger) Systemic RV with good or mildly decreased ventricular function Uncomplicated Fontan circulation: good ventricular function, no significant valve disease or arrhythmias, good exercise tolerance, and normal arterial saturations Ebstein anomaly with any complication	Systemic RV with moderate or severely decreased ventricular function Fontan with any Complication Eisenmenger syndrome

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Modified WHO 2.0 classification of maternal CV risk (4)

mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
Aortopathy				
Non-HTAD mild aortic dilatation (<40 mm)	Turner syndrome without cardiovascular features (BAV, coarctation, arterial hypertension [AHT], aortic dilatation)	Marfan or other HTAD syndrome without aortic dilatation Aorta <45 mm in BAV pathology Repaired coarctation	Moderate aortic dilatation: 40–45 mm in Marfan syndrome or other HTAD; 45–50 mm in BAV, Turner syndrome ASI 20–25 mm/m^2, other aortic dilatation <50 mm Marfan with previous aortic root replacement Previous aortic dissection with stable diameter	Severe aortic dilatation: >45 mm in Marfan syndrome or other HTAD, >50 mm in BAV, ASI >25 mm/m^2 in Turner syndrome, other aortic dilatation >50 mm Vascular Ehlers–Danlos syndrome Severe (re)coarctation Previous aortic dissection with increasing diameter
Acquired + coronary heart disease + other				
			Prior SCAD Prior ischaemic cardiac event (STEMI/NSTE ACS) Prior adverse pregnancy outcome requiring hospitalization Prior adverse cardiovascular effects of cancer treatment	

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Modified WHO 2.0 classification of maternal CV risk (5)

mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
Risk				
No detectable increased risk of maternal mortality and no/mild increased risk in morbidity	Small increased risk of maternal mortality or moderate increase in morbidity	Intermediate increased risk of maternal mortality or moderate to severe increase in morbidity	Significantly increased risk of maternal mortality or severe morbidity	Extremely high risk of maternal mortality or severe morbidity
Average maternal cardiac event rates				
Van Hagen et al 2016				
9.9%	7.7%	17.7%	28.9%	50.3%
Silversides et al 2018				
3.1%	21.7%	12.8%	21.1%	35.6%

Modified WHO 2.0 classification of maternal CV risk (6)

mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
Individualize each maternal risk with the modifiers below (derived from CARPREG II)				
CARPREG II score:1 point - No prior cardiac intervention indicated - Late pregnancy assessment	**CARPREG II score :2 points** - Ventricular dysfunction - High-risk left-sided valve disease or outflow tract obstruction - Pulmonary hypertension - Coronary artery disease - High-risk aortopathy		**CARPREG II** score:**3 points** - Prior cardiac event or arrhythmias - Baseline NYHA III/IV or cyanosis - Mechanical valve	
Involvement of the Pregnancy Heart Team				
No	No	Yes	Yes	Yes
Counselling				
Yes: (by regular healthcare professional)	Yes: (by regular healthcare professional)	Yes: expert counselling by Pregnancy Heart Team is required	Yes: expert counselling by Pregnancy Heart Team is required	Yes: expert counselling by Pregnancy Heart Team is required, with clear and thorough discussion of very high pregnancy risk and shared decision-making process for termination if pregnancy occurs
Obstetric and cardiac care during pregnancy				
Local hospital	Local hospital	Shared care with local hospital + Pregnancy Heart Team.	Care led by Pregnancy Heart Team in expert centre	Care led by Pregnancy Heart Team
Location of delivery				
Local hospital	Local hospital	Shared care with local hospital + Pregnancy Heart Team. Location depends on CV status and evolution of pregnancy	Expert centre, care led by Pregnancy Heart Team	Expert centre, care led by Pregnancy Heart Team

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Modified WHO 2.0 classification of maternal CV risk (7)

Estimation of maternal adverse cardiac event rate with integration of CARPREG II score

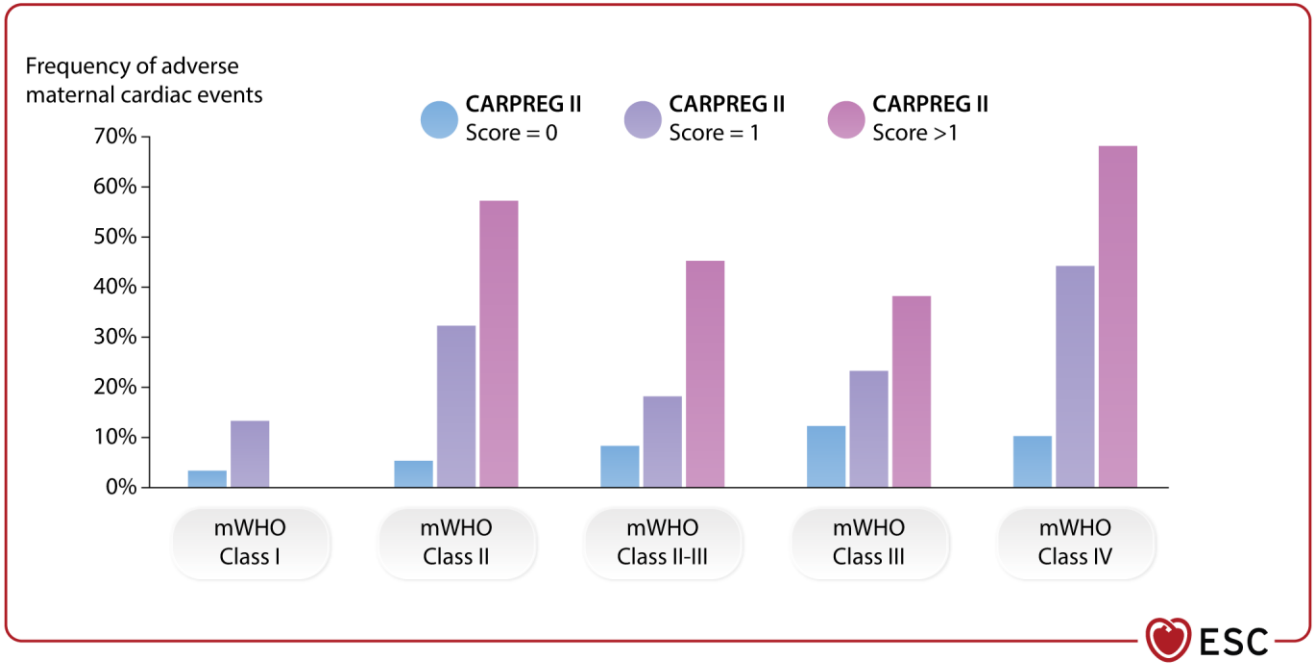

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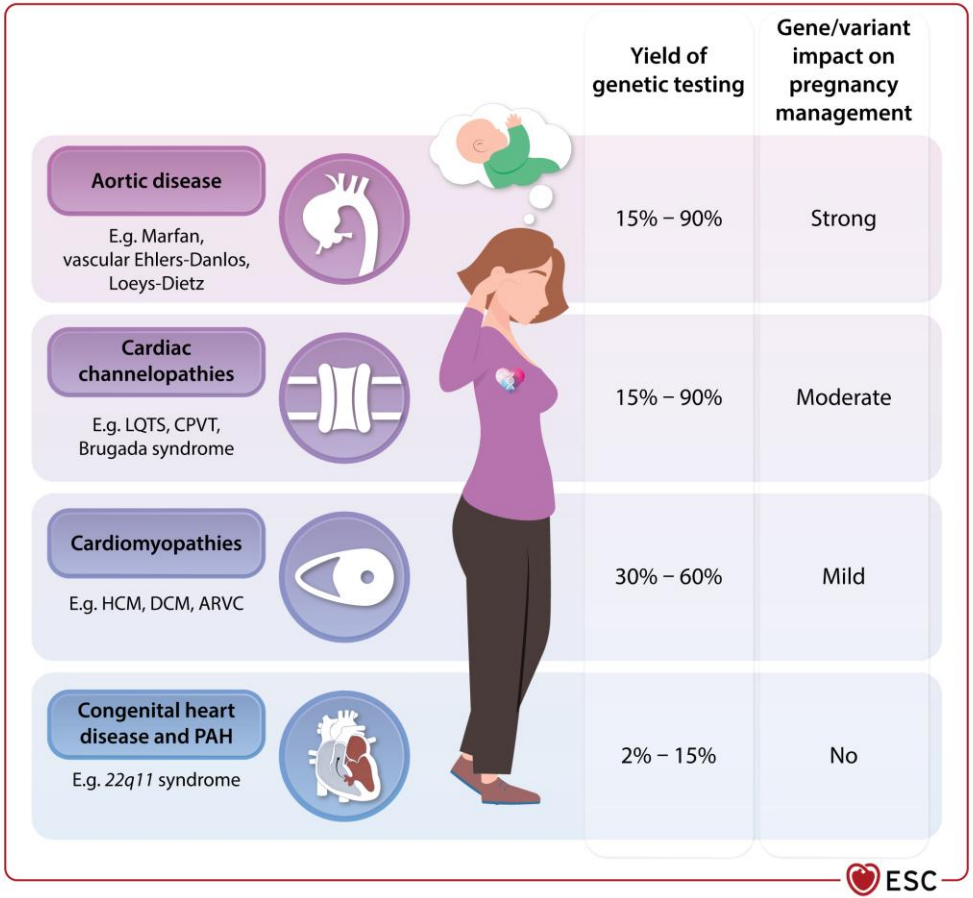
Figure 4

Pre-conception counselling and genetic aspects



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Pre-implantation and prenatal options and implications

Pre-implantation genetic diagnosis	IVF procedure followed by biopsy and genetic testing of a single cell of the embryo. Embryo transfer with success rate of 25%–30% per (dependent on mother's age and fertility).
	Risks to mother and offspring of IVF, such as multiple birth, premature labour and low birth weight, as well as side effects of hormonal treatment. Availability, expense and methods differ across countries.
Chorionic villus sampling	Transcervical or transabdominal sampling of the chorionic villi at the end of the first trimester.
	Procedure-related foetal loss rate ~0.2%.
Amniocentesis	Direct sampling of amniotic fluid after 15 weeks of gestation.
	Procedure-related foetal loss rate ~0.1%.

Overview of benefits and risks of different methods of contraception in women with CVD (1)

Method	Benefits	Cardiovascular risks	Cautious use and contraindications	Contraceptive efficacy
Hormonal oral contraceptives				
Progestin-only oral contraceptives	Minimal/no impact on coagulation factors Safe CV risk profile	Mild fluid retention	LQTS not on beta-blockers	++ *(general)* +++ *(for drospirenone)*
Combined oral contraceptives	Regular menstruation with reduced blood loss	VTE, hypertension and altered lipid profile	Known dyslipidaemia Pre-existing hypertension Obesity Cyanosis MHV Fontan circulation Risk factors for ACS	+++
Long-acting reversible contraceptives				
Levonorgestrel-releasing IUD	↓ Menstrual bleeding and iron loss	None specified	Vasovagal responses on insertion and removal (done by gynaecologist) → *caution and monitoring with availability of anaesthesiologist recommended in PAH and Fontan circulation*	Safest and most effective option +++

Overview of benefits and risks of different methods of contraception in women with CVD (2)

Method	Benefits	Cardiovascular risks	Cautious use and contraindications	Contraceptive efficacy
Long-acting reversible contraceptives continued				
Smaller levonorgestrel IUD	↓ Menstrual bleeding and iron loss Easier to insert ↓ Risk of vasovagal responses	None specified		+++
Copper IUD	↓ Cost		↑ Intensity of menstrual bleeding	+++
Etonogestrel-releasing subcutaneous implants	No pelvic infection risk	None specified	Surgical subcutaneous insertion *(in the forearm with local anaesthesia – outpatient procedure)*	+++
Depot medroxyprogesterone acetate injection	Lighter menses	Increased VTE risk, weight gain	Irregular bleeding	++

Overview of benefits and risks of different methods of contraception in women with CVD (3)

Method	Benefits	Cardiovascular risks	Cautious use and contraindications	Contraceptive efficacy
Barrier methods				
	↓ Pelvic infection risk		None specified	+
Permanent sterilization				
Tubal ligation **Vasectomy**	Permanent	Anaesthetic and procedural risks	Non-reversible	+++
Emergency contraception				
Oral contraceptive pills to delay ovulation				
Ulipristal acetate	↑ Effectiveness than levonorgestrel	No ↑ thrombosis risk	None specified	+++ *(only if taken before ovulation)*
Levonorgestrel *single dose of 1.5 mg <72 h after unprotected intercourse*		No ↑ thrombosis risk	None specified	++ *(only if taken before ovulation)*
Contraceptive device				
Copper IUD *<120 h after unprotected intercourse*			None specified	+++ *(in addition to ongoing contraception)*

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Recommendations for counselling, pregnancy risk assessment, contraception, assisted reproductive technology, and the involvement of a Pregnancy Heart Team (1)

Recommendations	Class	Level
Maternal risk assessment		
It is recommended to perform a risk assessment in all women with CVD of childbearing age using the mWHO 2.0 classification.	I	C
A discussion by the Pregnancy Heart Team about the high risk of maternal mortality or morbidity and the related high foetal risk is recommended for women with mWHO 2.0 class IV conditions, including a shared decision-making process for pregnancy termination, involving psychological support.	I	C
It is recommended that women with CVD of mWHO 2.0 class II–III and above are evaluated and managed by a Pregnancy Heart Team from pre-pregnancy onwards through pregnancy and post-partum.	I	C

Recommendations for counselling, pregnancy risk assessment, contraception, assisted reproductive technology, and the involvement of a Pregnancy Heart Team (2)

Recommendations	Class	Level
Methods of contraception		
It is recommended that women with CVD of mWHO 2.0 class II and above, or those at risk of developing CVD, receive individualized advice to determine the most suitable contraception method, including emergency contraception.	I	C
Progestin-only treatment, contraceptive implants, and/or levonorgestrel IUDs should be considered when there is any risk of thromboembolic events.	IIa	B
Genetic counselling		
Assessment by a clinical geneticist prior to pregnancy is recommended in women fulfilling diagnostic criteria for inherited cardiovascular disease to guide risk stratification and prenatal genetic testing.	I	C
Pre-conception genetic counselling is recommended in couples with heritable CVD, whether genetic testing is being considered or not. It is recommended that this counselling is provided by an appropriately trained healthcare professional within a multidisciplinary team that offers psychological support and education to encourage decision-making.	I	C

Recommendations for counselling, pregnancy risk assessment, contraception, assisted reproductive technology, and the involvement of a Pregnancy Heart Team (3)

Recommendations	Class	Level
Reproductive technology		
It is recommended that single embryo transfer is performed in women with CVD.	I	C
Pregnancy termination		
It is recommended to offer women with CVD access to termination of pregnancy which is tailored to their cardiac condition to minimize the risks of the procedure.	I	C

Recommendations for diagnostic methods in pregnancy (1)

Recommendations	Class	Level
Echocardiography		
Transthoracic echocardiography is recommended as first-line imaging tool in any pregnant woman with unexplained or new cardiovascular signs or symptoms.	I	C
Biomarkers		
Measurement of BNP and NT-proBNP levels should be considered prior to pregnancy in women with HF of any aetiology, including previous PPCM, cardiomyopathy, ACHD, and PAH, and be monitored during pregnancy according to the underlying disorder and in case of new-onset or worsening symptoms.	IIa	B
Cardiovascular magnetic resonance		
Discontinuation of lactation for 24 hours should be considered in women in whom i.v. gadolinium is required.	IIa	C
CMR imaging without gadolinium contrast should be considered for a definitive, clinically relevant diagnosis during pregnancy, if other non-invasive diagnostic measures are not sufficient.	IIa	C

Recommendations for diagnostic methods in pregnancy (2)

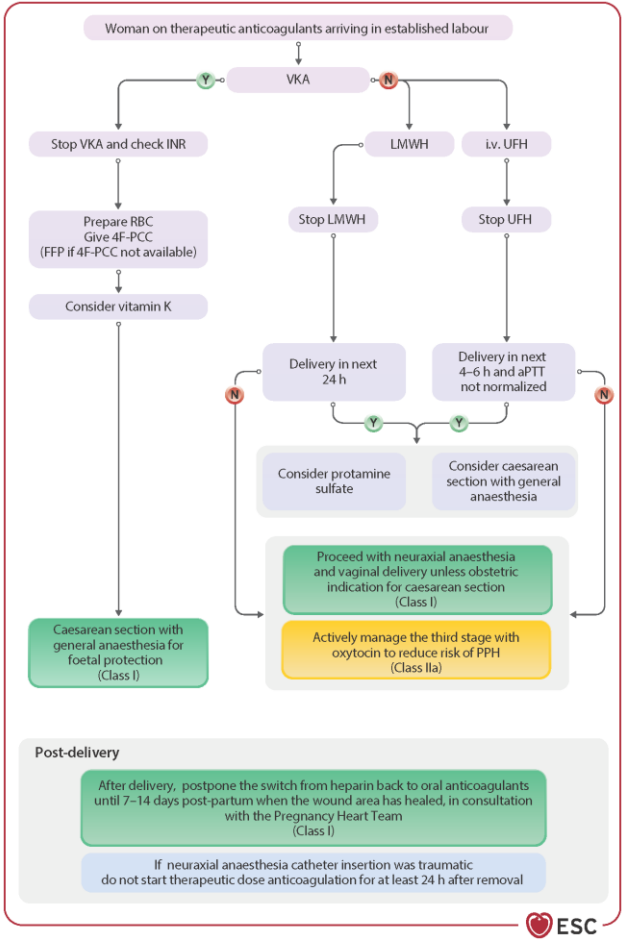
Recommendations	Class	Level
Ionizing radiation		
It is recommended to limit exposure to all medical ionizing radiation doses to ALARA levels.	I	C
It is recommended to keep the radiation dose to the foetus as low as possible (preferably <50 mGy), particularly if the foetus is in the field of view.	I	C
A CT scan should be considered for PE when clinical benefits outweigh the risks to the mother and foetus.	IIa	C
A chest radiograph may be considered as a first-line imaging tool if other methods are not successful in clarifying the cause of dyspnoea.	IIb	C
Coronary angiography with minimal radiation may be considered during pregnancy if potential benefits outweigh the risks.	IIb	C

Predictors of neonatal events in pregnancies of women with CVD

Predictors of neonatal events
NYHA class III/IV or cyanosis during baseline prenatal visit
Maternal left heart obstruction
Low maternal oxygen saturation (<90%)
Multiple gestations
Use of anticoagulants
Cardiac medication before pregnancy
Mechanical valve prosthesis
Maternal cardiac event during pregnancy
Maternal decline in CO during pregnancy

Figure 5

Management of urgent delivery in women under anticoagulants



Recommendations for timing and mode of delivery (1)

Recommendations	Class	Level
Timing and mode of delivery		
Vaginal delivery is recommended in most women with CVD.	I	B
Systemic antibiotic prophylaxis may be considered for delivery in women at high risk.	IIb	C
Routine induction of labour prior to 39 weeks is not recommended in women with stable CVD.	III	C
Delivery in women on anticoagulants		
It is recommended that the timing of delivery is planned to ensure safe and effective peripartum anticoagulation.	I	C
It is recommended to discontinue VKAs and start therapeutic-dose LMWH or adjusted-dose i.v. UFH at the 36th week of gestation or 2 weeks before the planned delivery.	I	C
In women at low risk on therapeutic-dose LMWH, neuraxial anaesthesia and vaginal delivery (or caesarean section for obstetric indications) is recommended 24 h after the last dose of LMWH.	I	C

Recommendations for timing and mode of delivery (2)

Recommendations	Class	Level
Delivery in women on anticoagulants cont.		
In women at high risk, it is recommended to convert LMWH to i.v. UFH at least 36 h prior to delivery and stop the UFH infusion 4–6 h prior to anticipated delivery. The aPTT should be normal before regional anaesthesia.	I	C
If delivery starts while the mother is on VKAs or <2 weeks after discontinuation of VKAs, caesarean section is recommended for foetal protection.	I	C
Post-delivery, it is recommended that the decision to restart LMWH or UFH is made after discussion with the Pregnancy Heart Team and the woman who gave birth.	I	C
It is recommended to postpone the switch from heparin back to oral anticoagulants until 7–14 days post-partum when the wound area has healed, in consultation with the Pregnancy Heart Team.	I	C
In women on therapeutic-dose LMWH, planned delivery should be considered at around 39 weeks to avoid the risk of spontaneous labour while fully anticoagulated.	IIa	C
In women who are on antenatal anticoagulation, active management of the third stage of labour with oxytocin should be considered.	IIa	C

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List of anticoagulation regimens and disease entities in which they are indicated

Indication	Type of anticoagulant	Dosing	Timing
Low thrombosis risk			
VTE prevention/no indication for oral anticoagulation	LMWH	Prophylactic dose	o.d.
Uncomplicated Fontan circulation	LMWH	Prophylactic dose	o.d.
Intermediate thrombosis risk			
VTE (DVT/PE) during pregnancy	LMWH	Therapeutic dose	o.d. or b.i.d.
Persistent/permanent AF at elevated thromboembolic risk	LMWH	Therapeutic dose	o.d. or b.i.d.
Decreased ventricular function (EF <35%) and/ or intracardiac thrombus	LMWH	Therapeutic dose	o.d. or b.i.d.
High thrombosis risk			
Mechanical heart valves			
1. First trimester			
Low VKA dose to achieve required INR	First trimester: VKA or LMWH	INR: weekly to every 2 weeks	
		LMWH: dose adjusted to peak anti-factor Xa level	b.i.d.
High VKA dose to achieve required INR	Switch to LMWH	Dose adjusted to peak anti-factor Xa level (weekly until threshold, every 2–4 weeks thereafter)	b.i.d.
2. From week 13: shared decision a. Continue/switch to VKA with weekly to every 2 weeks INR b. Continue LMWH with dose adjustment as above Delivery: refer to Section 4.5.7.2 (for urgent delivery) and Section 4.5.7.1 (for planned delivery)			

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Dosing regimens for the commonly used LMWHs

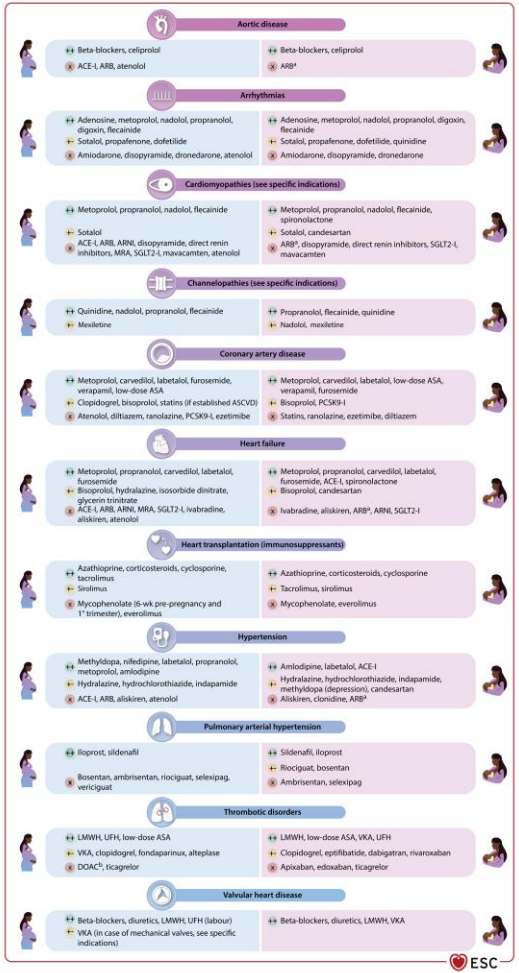
	Enoxaparin	Dalteparin	Tinzaparin	Target
Prophylactic LMWH *Body weight 50–100 kg*	4000 IU o.d.	5000 IU o.d.	4500 IU o.d.	NA
Therapeutic LMWH (non-MHV)	150 IU/kg o.d.	200 IU/kg o.d.	175 IU/kg o.d.	NA
Therapeutic LMWH *MHV*	125 IU/kg b.i.d. (starting dose) then 100 IU/kg b.i.d.	125 IU/kg (starting dose) b.i.d. then 100 IU/kg b.i.d.	250 IU /kg (starting dose) then 175 IU/kg o.d.	0.8–1.2 U/ml anti-factor Xa (4–6 h post administration)

Recommendation for direct oral anticoagulants and pregnancy

Recommendations	Class	Level
DOACs are not recommended during pregnancy.	III	C

Figure 6

Choice of medication during pregnancy (left) and during lactation and breastfeeding (right)



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Recommendations for cardiomyopathies and pregnancy (1)

Recommendations	Class	Level
Clinical cardiological surveillance (ECG, echocardiogram, and Holter ECG monitoring) is recommended during pregnancy in women with CMPs, depending on individual risk.	I	C
Vaginal delivery is recommended in most women with CMPs, unless there are obstetric indications for caesarean section, severe HF (EF <30% and/or NYHA class III/IV), uncontrolled arrhythmias, or severe outflow obstruction (≥50 mmHg) in women with HCM, or in women presenting in labour on VKAs.	I	C
Continuation of beta-blockers should be considered during pregnancy in women with CMPs, with close follow-up of foetal growth.	IIa	C
Dilated cardiomyopathy		
In women with DCM and worsening of EF during pregnancy, counselling on the risk of recurrence during a subsequent pregnancy is recommended in all cases, even after recovery of LV function.	I	C

Recommendations for cardiomyopathies and pregnancy (2)

Recommendations	Class	Level
Arrhythmogenic right ventricular cardiomyopathy		
Flecainide, in addition to beta-blockers, should be considered as the antiarrhythmic drug of choice in pregnant women with ARVC.	IIa	C
Sotalol may be considered as an antiarrhythmic drug in pregnant women with ARVC, with careful evaluation of QTc and while monitoring for foetal bradycardia and foetal growth and neonate hypoglycaemia.	IIb	C
Hypertrophic cardiomyopathy		
It is recommended to use the same risk stratification protocol for ventricular arrhythmias in pregnant women with HCM as for non-pregnant women with HCM.	I	C
It is recommended to start beta-blockers in women with HCM who develop symptoms due to outflow tract obstruction or arrhythmia during pregnancy.	I	C
It is recommended that women with HCM with symptomatic LV dysfunction (EF <50%) and or severe LVOTO (≥50 mmHg) wishing to become pregnant are counselled by the Pregnancy Heart Team regarding the high risk of pregnancy-related adverse events.	I	C

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Recommendations for cardiomyopathies and pregnancy (3)

Recommendations	Class	Level
Hypertrophic cardiomyopathy cont.		
Cardioversion for AF should be considered in pregnant women with HCM.	IIa	C
Disopyramide may be considered in pregnant women with HCM only when the potential benefits outweigh the risk of uterine contractions.	IIb	C
Myosin inhibitors are not recommended in women during pregnancy due to lack of safety data.	III	C

Recommendations for primary arrhythmia syndromes and pregnancy (1)

Recommendations	Class	Level
Monitoring and treatment of hypokalaemia and hypomagnesaemia is recommended in pregnant women with primary arrhythmia syndromes suffering from hyperemesis.	I	C
Long QT syndrome		
Beta-blockers, with pre-pregnancy dose and with nadolol and propranolol as drugs of choice, are recommended during pregnancy in women with LQTS.	I	B
It is recommended to continue beta-blocker therapy during lactation in women with LQTS to reduce arrhythmic risk.	I	B
Pre-pregnancy beta-blocker dose of nadolol or propranolol, is recommended in women with LQT2, particularly in the post-partum period, which represents a high-risk period for life-threatening arrhythmias.	I	B
In women carrying a LQTS P/LP variant and who are phenotype-negative, use of beta-blockers during pregnancy, post-partum, and lactation should be considered.	IIa	C
Left cardiac sympathetic denervation should be considered before pregnancy in high-risk woman with LQTS who are not adequately protected by pharmacological therapies or who have appropriate ICD shocks despite optimal medical therapy.	IIa	C

Recommendations for primary arrhythmia syndromes and pregnancy (2)

Recommendations	Class	Level
Brugada syndrome		
Quinidine therapy should be considered in pregnant women with BrS who have arrhythmic events during pregnancy.	IIa	C
Catecholaminergic polymorphic ventricular tachycardia		
Beta-blockers, with pre-pregnancy dose and with nadolol and propranolol as drugs of choice, are recommended during pregnancy and lactation in women with CPVT.	I	C
Flecainide, in addition to beta-blockers, is recommended in women with CPVT who experience cardiac events such as syncope, VT, or cardiac arrest during pregnancy.	I	C
It is recommended that women with CPVT who are stable on beta-blockers (nadolol or propranolol as drugs of choice) and flecainide before pregnancy, continue both drugs during pregnancy and post-partum.	I	C
The use of beta-blockers during pregnancy and lactation should be considered in phenotype-negative women with a CPVT P/LP variant.	IIa	C
Left cardiac sympathetic denervation should be considered before pregnancy in high-risk women with CPVT who are not adequately protected by pharmacological therapies or with appropriate ICD shocks despite optimal medical therapy.	IIa	C

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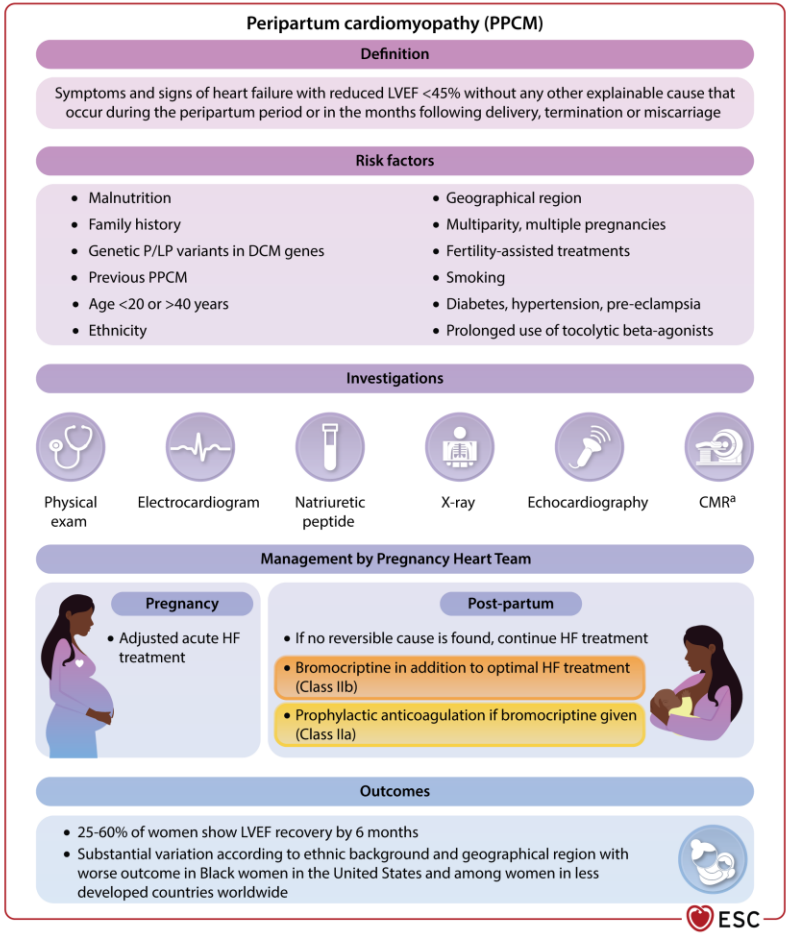
Recommendations for primary arrhythmia syndromes and pregnancy (3)

Recommendations	Class	Level
Short QT syndrome		
It should be considered to continue quinidine therapy in women with SQTS throughout pregnancy and the post-partum period.	IIa	C
Quinidine therapy should be considered in pregnant women with SQTS and arrhythmic events during pregnancy.	IIa	C

Figure 7

Risk factors and management of peripartum cardiomyopathy



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Recommendations for peripartum cardiomyopathy

Recommendations	Class	Level
Counselling for women with PPCM about the risk of recurrence during a subsequent pregnancy and about contraception is recommended in all cases, even after recovery of LV function (LVEF >50%).	I	C
Adding at least prophylactic LMWH treatment to bromocriptine treatment in women with PPCM should be considered.	IIa	C
Genetic counselling and testing should be considered in women with PPCM.	IIa	C
When a reversible course of HF is assumed, treatment in accordance with HF guidelines should be considered for at least 12 months after complete LV recovery (normalization of LV volumes and EF).	IIa	C
Bromocriptine treatment may be considered in addition to optimal HF treatment to enhance recovery of LV function in women with PPCM.	IIb	B
The use of a WCD may be considered in women with PPCM and LVEF <35%.	IIb	C

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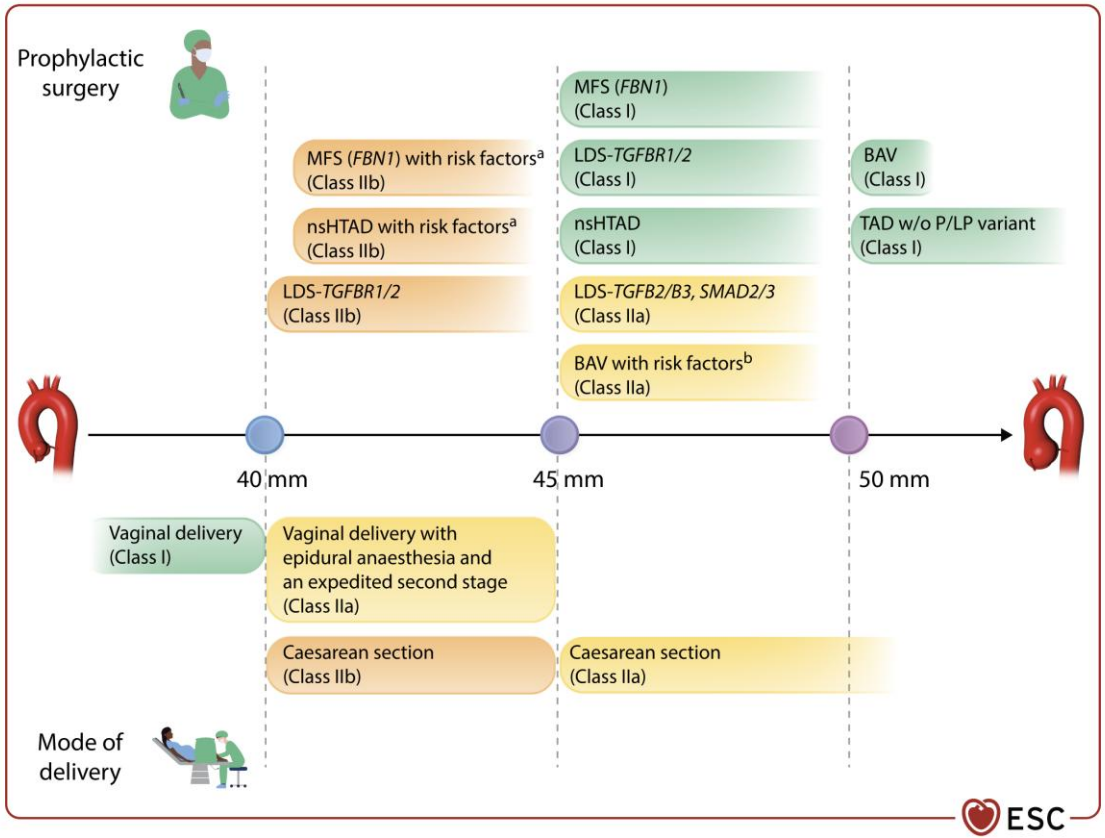
Figure 8

Thresholds for prophylactic surgical treatment prior to pregnancy of aortic root/ascending aneurysm (above the line) and recommended mode of delivery according to aortic diameter (below the line)



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Recommendations for aortopathies, cardiac surgery, and pregnancy (1)

Recommendations	Class	Level
Counselling		
It is recommended that women with aortic disease have counselling about the risk of aortic dissection in pregnancy and the post-partum period.	I	C
It is recommended that women with a history of aortic dissection or -surgery have pre-pregnancy counselling about the high risk by an extended Pregnancy Heart Team considering the presence and type of genetic variant, aortic morphology, growth rate, and aetiology of aortic dissection.	I	C
It is recommended that women with vascular Ehlers–Danlos syndrome wishing to become pregnant are counselled regarding the very high risk of pregnancy-related adverse events by a multidisciplinary team, considering family history, genetic variant, and previous vascular events.	I	C

Recommendations for aortopathies, cardiac surgery, and pregnancy (2)

Recommendations	Class	Level
Imaging		
Imaging of the entire aorta (CT or CMR) is recommended before pregnancy in women with known or suspected aortic disease.	I	C
In women with aortic dilatation related to BAV, imaging (with TTE, and CMR/CT if needed) of the aortic root, ascending aorta, and descending aorta (to rule out coarctation) is recommended before pregnancy.	I	C
In women with low-risk aortic disease (mWHO 2.0 classes II and II–III), one-time echocardiographic imaging between 20–30 weeks of gestation and imaging at 6 months post-partum is recommended.	I	C
In women with moderate to high-risk aortic disease (mWHO 2.0 classes III and IV), repeated echocardiographic imaging every 4–12 weeks (depending on diagnosis and severity of dilatation) is recommended during pregnancy and until 6 months post-partum.	I	C
CMR (without gadolinium) imaging of the entire aorta is recommended in pregnant women at risk of or with known aortic dilatation who have not had recent pre-pregnancy cross sectional imaging.	I	C

Recommendations for aortopathies, cardiac surgery, and pregnancy (3)

Recommendations	Class	Level
Treatment - medical		
When a woman with known aortic dilatation, history of dissection, or P/LP variant associated with aortic disease becomes pregnant, strict and individualized BP control is recommended.	I	C
Beta-blocker therapy[e] throughout pregnancy and in the post-partum period is recommended in women with MFS and other HTADs.	I	C
Celiprolol is recommended in women with vascular Ehlers–Danlos syndrome during pregnancy and lactation.	I	C

Recommendations for aortopathies, cardiac surgery, and pregnancy (4)

Recommendations	Class	Level
Treatment – intervention/surgical		
It is recommended that indications for pre-pregnancy aortic root and/or ascending aortic surgery are guided by aortic morphology, underlying pathology, family history, genetic variant, previous vascular events, and patient's preference.	I	C
It is recommended that centres managing pregnancies in women with moderate to high-risk aortic disease (mWHO 2.0 class III/IV) can provide cardiovascular surgery in case of peripartum adverse events.	I	C
Specific conditions		
In women with MFS and aortic root diameters >45 mm, surgery before pregnancy is recommended.	I	C
In women with LDS with P/LP variants in *TGFBR1*, *TGFBR2,* and aortic root diameters ≥45 mm, surgery before pregnancy is recommended.	I	C
In women with nsHTAD with P/LP variants in *MYH11*, *ACTA2*, *PRKG1*, or *MYLK*, and aortic root diameters ≥45 mm, surgery before pregnancy is recommended.	I	C
In women with BAV and aortic root or ascending aortic diameter ≥50 mm, surgery before pregnancy is recommended.	I	C

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Recommendations for aortopathies, cardiac surgery, and pregnancy (5)

Recommendations	Class	Level
Specific conditions cont.		
In women without an identifiable P/LP variant with aortic root or ascending aortic diameters ≥50 mm, surgery before pregnancy is recommended.	I	C
In women with HTAD and aortic arch, descending aortic, or abdominal aortic diameters ≥50 mm, surgery before pregnancy should be considered.	IIa	C
In women with LDS with P/LP variants in *TGFB2*, *TGFB3*, *SMAD2*, and *SMAD3*, and aortic root diameters ≥45 mm, surgery before pregnancy should be considered.	IIa	C
In women with BAV and root phenotype or family history of aortic aneurysm or dissection, surgery before pregnancy should be considered if the aorta is ≥45 mm.	IIa	C
In women without an identifiable P/LP variant with aortic root or ascending aortic aneurysm ≥45 mm, surgery before pregnancy should be considered in the presence of a family history of aortic aneurysm, aortic dissection, uncontrolled arterial hypertension, or on patient's preference.	IIa	C
In women with MFS and aortic root diameters between 40–45 mm, surgery before pregnancy may be considered if risk factors (growth >3 mm/year, family history of aortic dissection) are present.	IIb	C

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Recommendations for aortopathies, cardiac surgery, and pregnancy (6)

Recommendations	Class	Level
Specific conditions cont.		
In women with LDS with P/LP variants in *TGFBR1* or *TGFBR2* and aortic root diameters ≥40 mm, surgery before pregnancy may be considered.	IIb	C
In women with nsHTAD and aortic root diameters ≥40–44 mm, surgery before pregnancy may be considered depending on the genetic variant, family history, and aortic growth rate.	IIb	C
Delivery		
In women with an aorta <40 mm, vaginal delivery is recommended.	I	C
In women with vascular Ehlers–Danlos syndrome, caesarean section at 37 weeks is recommended for obstetrical reasons.	I	C
In women with an aorta 40–45 mm, vaginal delivery with epidural anaesthesia and an expedited second stage should be considered.	IIa	C
In women with an aorta ≥45 mm, caesarean section should be considered.	IIa	C
In women with acute, subacute, or chronic aortic dissection, caesarean section should be considered.	IIa	C
In women with an aorta 40–45 mm, caesarean section may be considered.	IIb	C
The use of ergometrine post-delivery is not recommended in women with aortopathy.	III	C

Recommendations for aortopathies, cardiac surgery, and pregnancy (7)

Recommendations	Class	Level
Cardiac surgery during pregnancy		
Delivery before cardiac surgery should be considered as soon as the foetus is viable, taking gestational age, comorbidities, and the available level of neonatal care into account.	IIa	C
Cardiac surgery may be considered during pregnancy when conservative and medical therapy has failed, and in situations that threaten the mother's life or that are not amenable to percutaneous treatment.	IIb	C

Risks, monitoring, and management during pregnancy and delivery in women with congenital heart disease (1)

ACHD	Maternal Risk	Obstetric and foetal risk	Monitoring	Pregnancy management & delivery
Left ventricular outflow tract obstruction (LVOTO)				
Coarctation of the aorta	• ↑ Complication risk if residual obstruction (gradient >20 mmHg, aortic lumen <12 mm), clinical signs of HF, LVEF <40%, NYHA class>1 • ↑ Risk of aortic dissection (if aneurysm present) • Uncontrolled hypertension	• ↑ Miscarriage rate • Preterm birth & low birth weight in 9%	• Close BP monitoring – also early post-partum • Pre-pregnancy CMR and treatment of residual lesions	• Treat hypertension • Consider bed rest, hospital admission & stenting in case of severe symptomatic (re)coarctation (including refractory hypertension or maternal/foetal compromise) • Vaginal delivery preferred unless aneurysm, HF, severe hypertension
Subvalvular, valvular and supravalvular aortic stenosis: see Section 12.5.1 and Section 8.3 for BAV related aortic disease. Women with serial left heart obstructive lesions have higher maternal cardiovascular event rates.				

Risks, monitoring, and management during pregnancy and delivery in women with congenital heart disease (2)

ACHD	Maternal Risk	Obstetric and foetal risk	Monitoring	Pregnancy management & delivery
Shunt lesions				
ASD	• Low risk in (un)repaired ASD (if no PAH) • *Unrepaired ASD:* • ↑ Risk of arrhythmia (4%) • Paradoxical embolism (2%–5%)	Rare *Unrepaired ASD:* • SGA (21%) • Foetal/ perinatal mortality (2%–3%) • Pre-eclampsia (7%)	*Unrepaired and uncomplicated ASD:* consider TTE at 28–32 weeks	• Large and/or haemodynamically significant ASD: closure pre-pregnancy *Unrepaired ASD:* • Consider ASA or prophylactic LMWH for paradoxical embolism prevention • Consider device closure in pregnancy only for recurrent stroke on medical therapy
VSD and patent ductus arteriosus	Low risk in small or repaired lesions with normal LV and no PAH	No evidence for ↑ risk	*Unrepaired and uncomplicated VSD:* consider TTE at 28–32 weeks	Vaginal delivery is preferred
AVSD	• Low risk in repaired AVSD without significant residual lesions • Arrhythmia and ↑ AV valve regurgitation and HF if residual left AV valve regurgitation • ↑ Paradoxical emboli risk in unoperated (partial) AVSD	• Offspring mortality in 6% primarily due to recurrence of the congenital heart disease	*Unrepaired and uncomplicated AVSD:* consider TTE at 28–32 weeks ↑ FU frequency in significant valve regurgitation, PAH, ↓ ventricular function, or ↑ NYHA class	• Residual shunt: see ASD and/or VSD • ↑ AV valve regurgitation and/or HF • PAH • Delivery: see ASD and VSD

Risks, monitoring, and management during pregnancy and delivery in women with congenital heart disease (3)

ACHD	Maternal Risk	Obstetric and foetal risk	Monitoring	Pregnancy management & delivery
Pulmonary valve & RVOT disease				
RVOTO/PV stenosis	• *Mild to moderate*: low risk • *Severe*: RV failure and arrhythmia	• Very low complication risk	*Mild to moderate:* • TTE at 28–32 weeks *Severe stenosis:* • (Bi)monthly TTE (focused on RV function)	*Pre-pregnancy severe RVOTO (Doppler peak gradient>64 mmHg) or/and any signs of right HF:* • Intervention (at any level of the RVOT) *Severe symptomatic PV stenosis (not responding to bed rest and conservative management):* • Consider transcatheter balloon valvotomy • Consider caesarean section in severe RVOTO/PV stenosis
PV regurgitation	• ↑ Risk when impaired RV function	• Premature birth	Bimonthly TTE if severe PV regurgitation and ↓ RV function	
Post pulmonary valve replacement (surgical or transcatheter without severe stenosis/regurgitation)	• Low risk	• Very low complication risk	TTE at 28–32 weeks	Vaginal delivery is preferred

Risks, monitoring, and management during pregnancy and delivery in women with congenital heart disease (4)

ACHD	Maternal Risk	Obstetric and foetal risk	Monitoring	Pregnancy management & delivery
Repaired TOF				
	• Low risk if no residual lesions • ↑ Risk of arrhythmia and HF (7%–10%) if pulmonary regurgitation, ↓ RV function, severe RVOTO	• 15% risk of foetal and obstetric complications, mainly preterm delivery and low birth weight • Low foetal mortality (0.7%) • Recurrence risk in the offspring in *22q11* deletion syndrome: 50%	• First trimester and at 28–32 weeks FU with TTE (increase FU depending on functional status)	• RV failure management: Bed rest and diuretics • Arrhythmia management • Severe PV stenosis/regurgitation: see above • Vaginal delivery is preferred • Consider caesarean section in severe RVOTO/PV stenosis
Ebstein anomaly				
	• Overall MACE rate in ROPAC 9.9% • Low risk in mild/ moderate Ebstein • (Very) high risk when pre-pregnancy HF, cyanosis due to atrial shunt • ↑ Arrhythmia risk due to accessory pathways	Foetal risk is related to ↓ maternal CO and cyanosis: • Miscarriage • Preterm birth (20%–24%) • Neonatal death (3%) • PPH • Recurrence risk (5%)	• *Mild to moderate*: baseline & 28–32 weeks assessment with TTE & ECG • *Severe*: monthly/bimonthly TTE & ECG • Monitor for arrhythmias if palpitations	• Severe tricuspid regurgitation with HF can usually be managed medically • Treat arrhythmias promptly • Appropriate pre-pregnancy counselling about very high risk of MACE when HF and/or cyanosis

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Risks, monitoring, and management during pregnancy and delivery in women with congenital heart disease (5)

ACHD	Maternal Risk	Obstetric and foetal risk	Monitoring	Pregnancy management & delivery
Transposition of the great arteries				
TGA after atrial switch (Mustard or Senning) and CCTGA	• High pregnancy risk – MACE rate up to 28% in retrospective series– lower risk in ROPAC: Atrial and ventricular arrhythmias in 6.7%, HF in 10% • Atrial arrhythmias often poorly tolerated • Baffle leaks may lead to desaturation and paradoxical embolism • Predictors of MACE: symptoms of HF before pregnancy and systemic RV EF <40%	• Foetal risks associated with maternal CO and saturation • Preterm birth (21%) • Low birth weight (18%–21%) • Rare foetal and neonatal death (1%) • PPH (7%)	• According to anatomical and functional status: TTE every 1–3 months and serial NP • Holter monitoring if palpitations	• Pre-pregnancy counselling about very high risk if NYHA class III/IV, systemic RV EF <40%, more than moderate tricuspid regurgitation, or treated HF • Treat HF primarily with medical therapy • Promptly treat arrhythmia • Consider prolonged post-partum monitoring (48–72 h) and early post-partum FU given the ↑ risk of post-partum HF No clear evidence for long-term deterioration or ↑ cardiovascular events associated with pregnancy
TGA with arterial switch	• Low risk • Ventricular arrhythmias (2.5%–7%), HF (2%–4%)	• Low rate of prematurity or foetal loss	• Consider TTE at 20 weeks • Intensify if ↓ ventricular function, ↑ aortic regurgitation and ↑ aortic dilatation	• Vaginal delivery is preferred • Surgery before pregnancy when the neo-aortic root is >55 mm or if severe AR •

Risks, monitoring, and management during pregnancy and delivery in women with congenital heart disease (6)

ACHD	Maternal Risk	Obstetric and foetal risk	Monitoring	Pregnancy management & delivery
Single ventricle physiology palliated with Fontan circulation				
	High pregnancy risk *CV events*: • Supraventricular arrhythmias (8%–11%) • HF (4%–14%) *Risk factors:* • Oxygen saturations <85% • ↓ Ventricular function • Arrhythmias • Significant valvular disease • NYHA class III/IV • FALD	↑ *Very high foetal complication risk:* • Low live birth rate (56%) • Miscarriages (45%–54%) • SGA (20%–55%) • Premature birth (59%–72%) • Neonatal death (5%–18%) *Obstetric risk:* • Hypertension (14%) • PPH (13%)	• According to anatomical and functional status: TTE every 1–3 months and serial NP • FU in specialized ACHD centre	• Pre-pregnancy counselling about very high risk especially if any risk factor (see maternal risk) • Pregnancy may be well tolerated and successful in a subset of women with single ventricle and Fontan circulation without complications • ASA and/or LMWH (depending on the presence of complications) should be considered in shared decision • Atrial tachyarrhythmias should be promptly treated with cardioversion *Labour/delivery with preload dependent circulation:* • Epidural with slow titration • Labour in left lateral decubitus position • Low thresholds for assisted second stage (↓ Valsalva duration) • i.v. air filter (if fenestration or significant venovenous collaterals)

Risks, monitoring, and management during pregnancy and delivery in women with congenital heart disease (7)

ACHD	Maternal Risk	Obstetric and foetal risk	Monitoring	Pregnancy management & delivery
Unrepaired cyanotic ACHD (without pulmonary hypertension)				
	HF, thrombosis, arrhythmia and endocarditis in ≥15%	Degree of maternal hypoxaemia is the most important predictor of foetal outcome: 10% foetal loss if resting maternal blood saturation >90%, chance of a live birth 12% if maternal oxygen saturation<85%	FU in expert centre	• Pre-pregnancy counselling about very high risk especially if maternal resting saturation <85% • i.v. air filter

Recommendations for congenital heart disease and pregnancy

Recommendations	Class	Level
Vaginal delivery is recommended in most women with ACHD.	I	B
It is recommended that all women with Fontan circulation who wish to become pregnant receive counselling from the Pregnancy Heart Team regarding the high risk of pregnancy-related adverse events.	I	C
It is recommended that women with a systemic RV (Mustard/Senning or congenitally corrected TGA), in NYHA class III/IV, systemic ventricular dysfunction (EF <40%), or severe TR wishing to become pregnant are counselled by the Pregnancy Heart Team regarding the high risk of pregnancy-related adverse events.	I	C
In women with significant haemodynamic lesions, discussion about guideline-directed interventions is recommended prior to pregnancy.	I	C

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Recommendations for pulmonary arterial hypertension and pregnancy

Recommendations	Class	Level
It is recommended that women of childbearing potential with PAH wishing to become pregnant are counselled by a multidisciplinary team regarding the very high risk of pregnancy-related adverse events, encouraging a shared decision-making process about whether to become pregnant.	I	C
It is recommended to provide clear contraceptive advice to women of childbearing potential with PAH.	I	C
For women with PAH requiring pregnancy termination, it is recommended to perform this in PH centres.	I	C
Right-heart catheterization should be considered during pregnancy if there is diagnostic uncertainty or to assist with important therapeutic decisions.	IIa	C
Endothelin receptor antagonists, riociguat, and selexipag are not recommended during pregnancy.	III	C

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Reasons for antepartum/post-partum thromboprophylaxis

Medical conditions	Antepartum thromboprophylaxis	Post-partum thromboprophylaxis
History of unprovoked VTE	👍	👍
History of hormone-associated VTE	👍	👍
Homozygous factor V Leiden mutation	👍	👍
Heterozygous factor V Leiden mutation	👎	👎
Homozygous prothrombin gene mutation	👍	👍
Heterozygous prothrombin gene mutation	👎	👎
Antithrombin deficiency	👍	👍
Antiphospholipid syndrome	👍	👍
Protein C or S deficiency	👎	👍
Combined thrombophilia	👍	👍

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Figure 9

Algorithm for the diagnosis and treatment of deep vein thrombosis during pregnancy

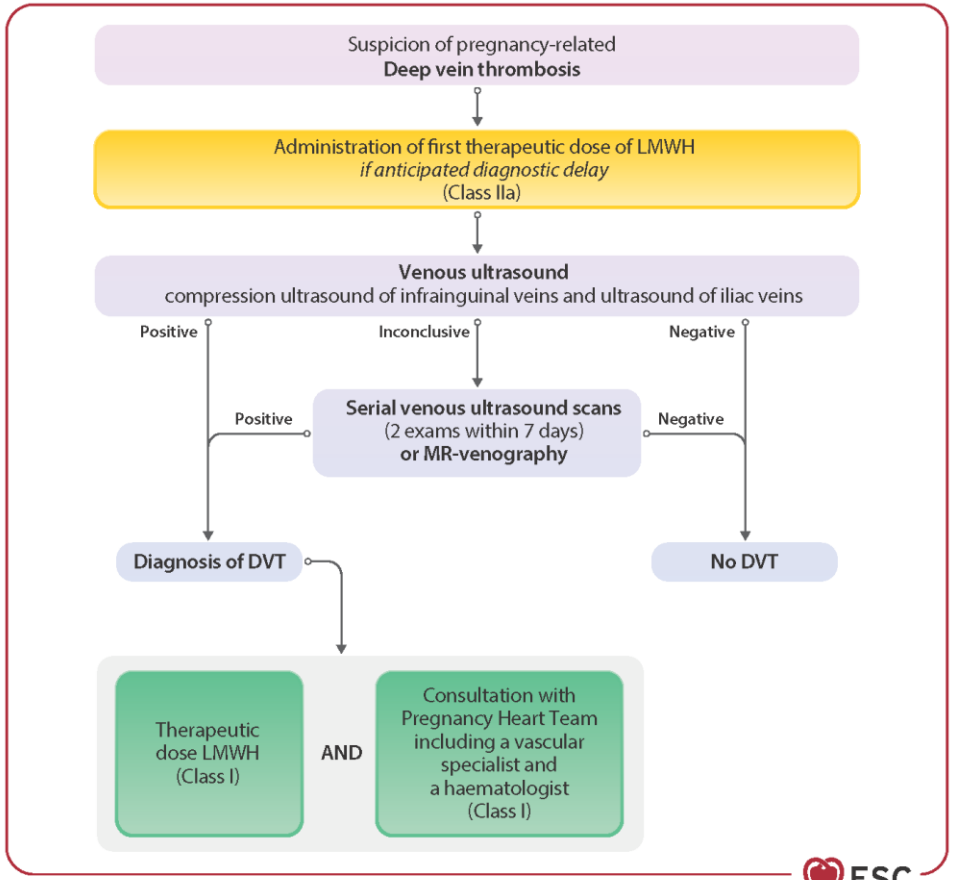
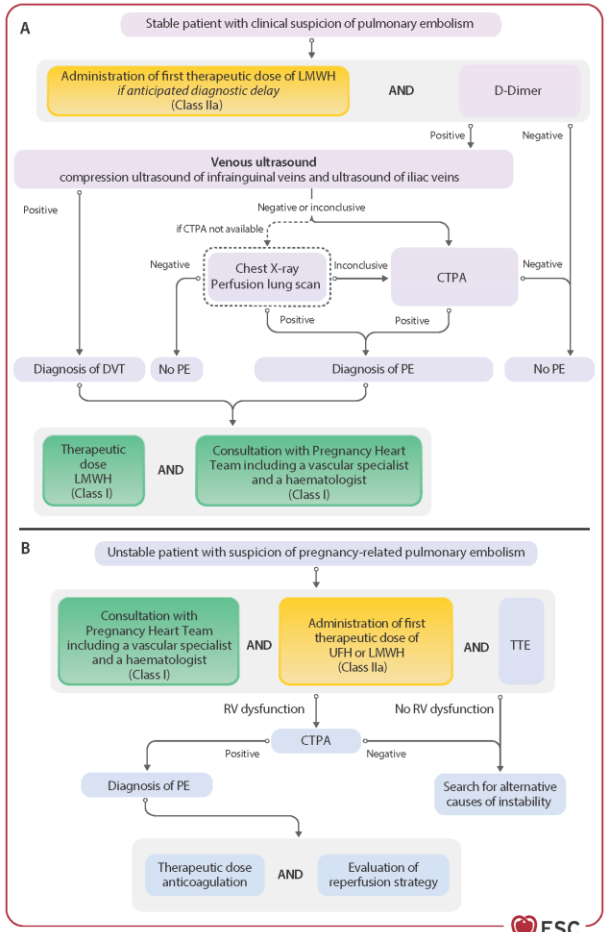


Figure 10

Algorithm for the diagnosis and treatment of pulmonary embolism in pregnancy in stable (A) and unstable women (B)



Recommendations for venous thromboembolic diseases and pregnancy (1)

Recommendations	Class	Level
For pregnant or post-partum women at high risk of VTE, a prophylactic fixed dose of LMWH is recommended over a higher weight-adjusted dose to reduce the risk of VTE.	I	B
In pregnant women or women in the post-partum period with suspicion of VTE (DVT and/or PE), an immediate formal diagnostic assessment with validated methods is recommended and should not be postponed.	I	B
In pregnant women or women in the post-partum period with newly diagnosed VTE (DVT and/or PE), the involvement of the Pregnancy Heart Team, including a vascular specialist and a haematologist, is recommended.	I	C
In pregnant or post-partum women with a diagnosis of VTE without haemodynamic instability, anticoagulation is recommended by using therapeutic-dose LMWH based on early pregnancy body weight.	I	C
In pregnant women or women in the post-partum period with a strong clinical suspicion of VTE, initiation of treatment with a therapeutic dose of LMWH should be considered until the presence of VTE has been ruled out or confirmed.	IIa	C

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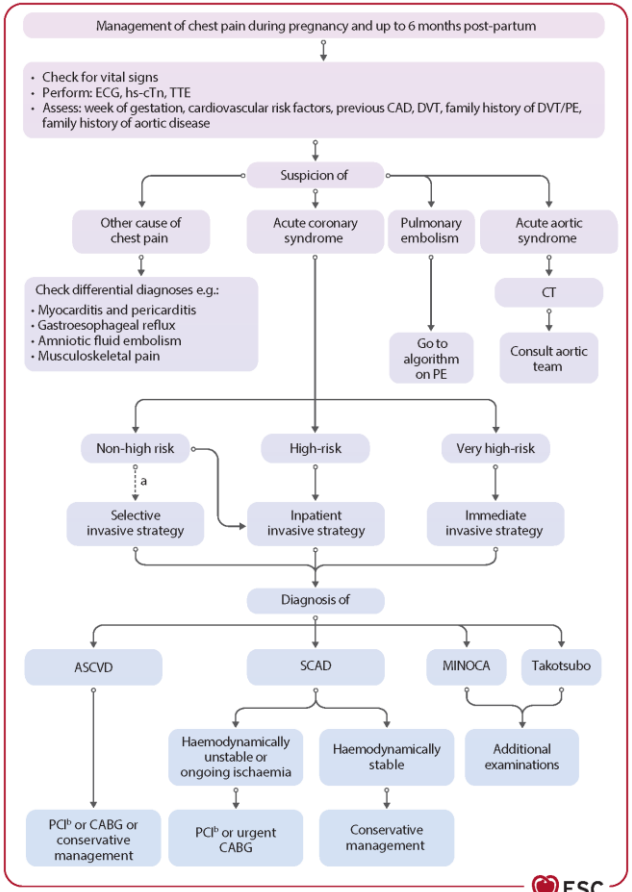
Recommendations for venous thromboembolic diseases and pregnancy (2)

Recommendations cont.	Class	Level
In pregnant or post-partum women with a diagnosis of acute high-risk PE, a catheter-based reperfusion strategy or systemic thrombolysis should be considered.	IIa	C
In pregnant or post-partum women with a diagnosis of acute high-risk PE, surgical thrombectomy may be considered as an alternative to a catheter-based approach or systemic thrombolysis.	IIb	C

Figure 11

Management of chest pain during pregnancy and within 6 months post-partum



Recommendations for coronary artery disease and pregnancy

Recommendations	Class	Level
In pregnant women with chest pain, it is recommended to exclude life-threatening cardiovascular conditions, including PE, ACS (including SCAD), and acute aortic syndrome.	I	C
It is recommended to manage pregnant women with ACS in the same way as non-pregnant women, including diagnostic investigations and interventions.	I	C
Low-dose ASA is recommended as the antiplatelet treatment of choice during pregnancy and lactation when single antiplatelet treatment is indicated.	I	B
If DAPT is required, clopidogrel is recommended as the P2Y12 inhibitor of choice during pregnancy.	I	C
The duration of DAPT (aspirin and clopidogrel) in pregnant women undergoing coronary stent implantation is recommended to be the same as in non-pregnant women, with an individual approach considering ischaemic risk and delivery-related bleeding risks.	I	C
A vaginal delivery should be considered in most pregnant women with ACS, depending on LV function and clinical symptoms.	IIa	C
Continuation of statins may be considered during pregnancy in women with established ASCVD.	IIb	C

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Hypertensive disorders of pregnancy

A. Pre-existing (chronic) hypertension

Hypertension which either precedes pregnancy or develops before 20 weeks gestation, usually persisting >6 weeks post-partum, and which may be associated with proteinuria.

1. Primary hypertension;
2. Secondary hypertension;
3. White-coat hypertension;
4. Masked hypertension.

B. Gestational hypertension

Hypertension which develops after 20 weeks gestation and usually resolves within 6 weeks post-partum.

Transient gestational hypertension

Usually detected in the clinic but then settles with repeated BP measurements taken over several hours; associated with a 40% risk of developing true gestational hypertension or pre-eclampsia in the remainder of the pregnancy, thus requiring careful follow-up.

C. Pre-eclampsia

Gestational hypertension accompanied by one or more of the following new-onset conditions at or after 20 weeks gestation:

- Proteinuria (urinary albumin excretion in a 24 h urine sample >0.3 g/day or UACR in a random spot urine sample >30 mg/mmol [0.3 mg/mg]);
- Other maternal organ dysfunction including:
  - Acute kidney injury (serum creatinine ≥90 µmol/L; 1 mg/dL);
  - Liver dysfunction (elevated ALT or AST >40 IU/L; >0.67 µkat/L with or without right upper quadrant or epigastric abdominal pain);
  - Neurological complications (e.g. eclampsia/convulsions, altered mental status, blindness, stroke, clonus, severe headaches, persistent visual scotomata);
  - Haematological complications (platelet count <150 000/µL, disseminated intravascular coagulation, haemolysis);
- Uteroplacental dysfunction (foetal growth restriction, abnormal umbilical artery Doppler waveform analysis, or stillbirth).

D. Pre-existing hypertension + superimposed pre-eclampsia

Pre-existing hypertension associated with any of the above maternal organ dysfunctions consistent with pre-eclampsia or a further increase in BP with new-onset proteinuria.

E. Antenatally unclassifiable hypertension

When BP is first recorded after 20 weeks gestation and hypertension is diagnosed, reassessment is necessary at or after 6 weeks post-partum. If hypertension resolves, it should be reclassified as gestational hypertension, whereas if hypertension persists, it should be reclassified as pre-existing/chronic hypertension.

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Risk factors for pre-eclampsia

High risk factors for pre-eclampsia
Hypertensive disorders during a previous pregnancy
Chronic hypertension
Chronic kidney disease
Type 1 or type 2 diabetes mellitus
Autoimmune diseases such as systemic lupus erythematosus or antiphospholipid syndrome
Assisted reproductive therapy in the current pregnancy
Moderate risk factors for pre-eclampsia
Nulliparity
Age ≥40 years
Pregnancy interval of more than 10 years
BMI ≥35 kg/m^2 at the first visit
Family history of pre-eclampsia
Multi-foetal pregnancy

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Figure 12A

Management of hypertension and pre-eclampsia in the emergency ward

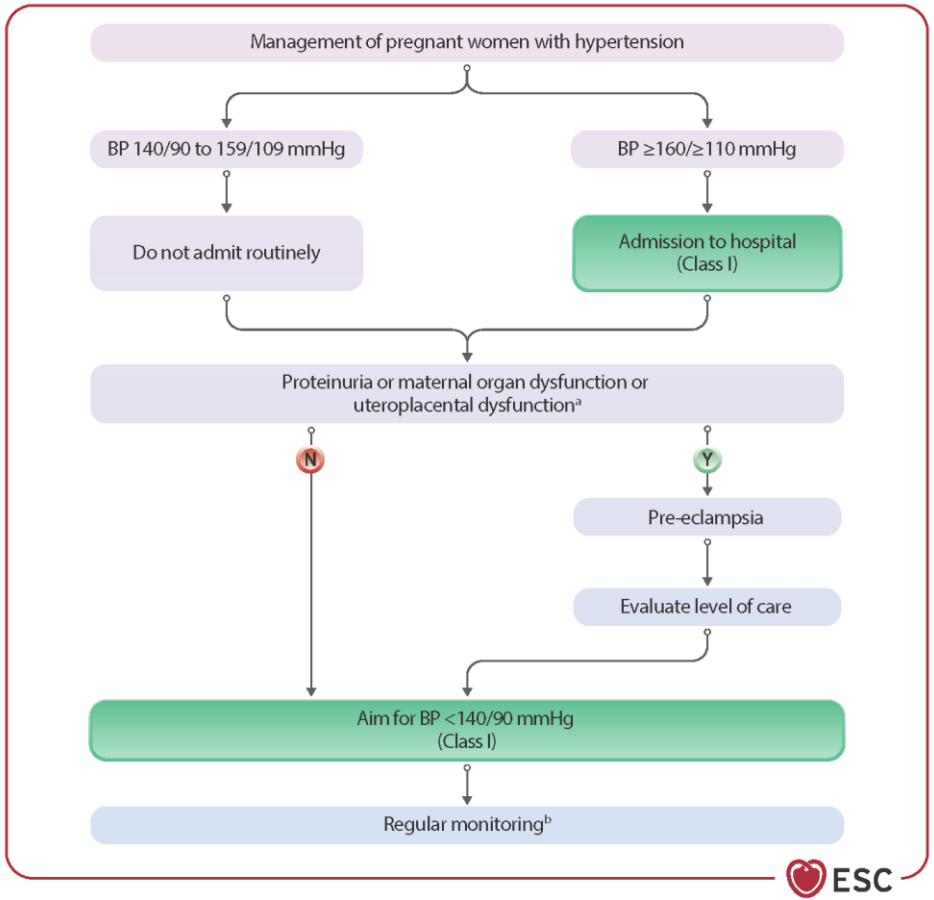


Figure 12B

Proteinuria assessment and diagnosis of pre-eclampsia

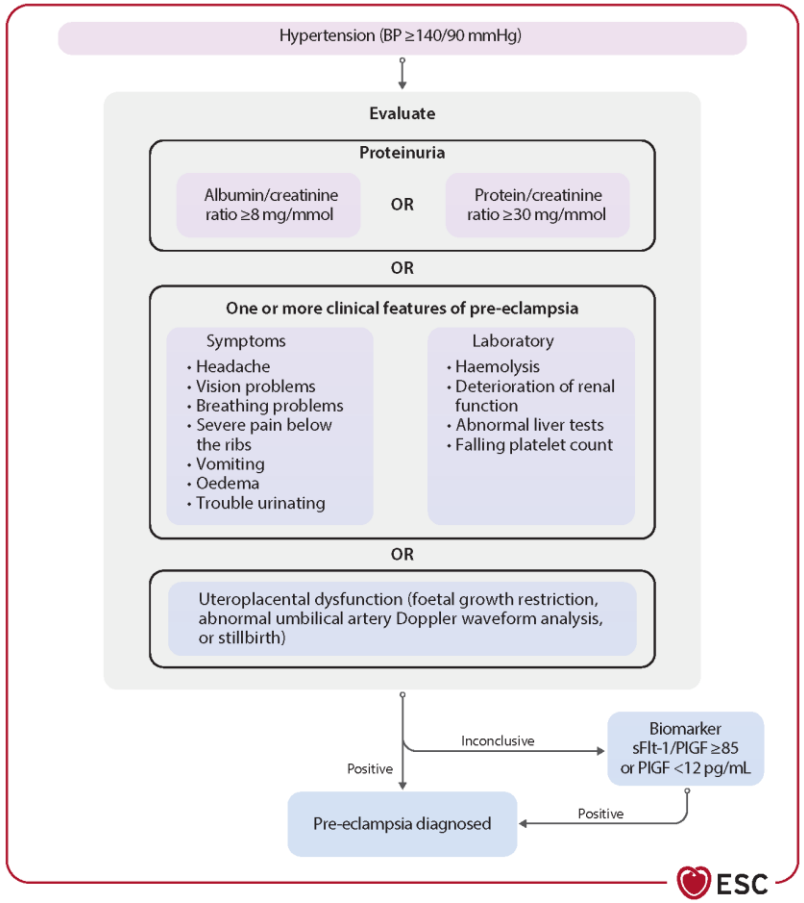
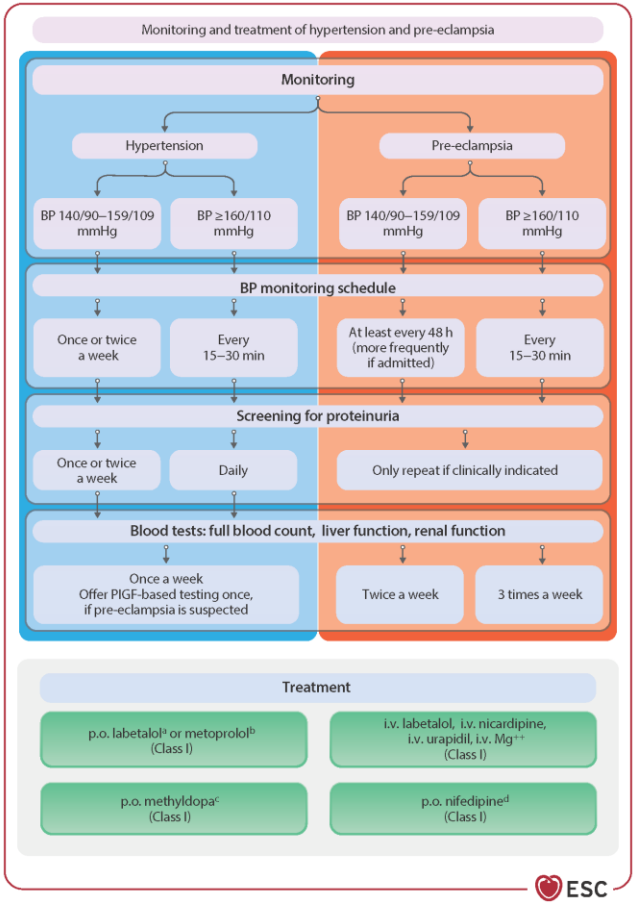


Figure 12C

Monitoring and treatment of hypertension and pre-eclampsia



Recommendations for hypertensive disorders and pregnancy (1)

Recommendations	Class	Level
It is recommended to aim for systolic BP <140 mmHg and diastolic BP <90 mmHg in pregnant women.	I	B
Systolic BP ≥160 mmHg or diastolic BP ≥110 mmHg in a pregnant woman is an emergency, and treatment in a hospital setting is recommended.	I	C
Low-dose aspirin (75–150 mg daily) is recommended in women at moderate or high risk of pre-eclampsia (i.e. at least one high risk factor or two moderate risk factors for pre-eclampsia) from weeks 12–36/37.	I	A
In women with gestational hypertension, initiation of drug treatment is recommended at systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg[c].	I	B
Methyldopa is recommended for the treatment of hypertension in pregnancy.	I	B
Labetalol, metoprolol, and dihydropyridine calcium channel blockers are recommended for the treatment of hypertension in pregnancy.	I	C

Recommendations for hypertensive disorders and pregnancy (2)

Recommendations cont.	Class	Level
In severe hypertension, drug treatment with i.v. labetalol, urapidil, nicardipine, or oral short acting nifedipine or methyldopa is recommended for acute reduction in blood pressure. I.v. hydralazine is a second-line option.	I	C
In pre-eclampsia associated with pulmonary oedema, nitroglycerine given as an i.v. infusion is recommended.	I	C
In women with pre-eclampsia without severe features, delivery is recommended at 37 weeks.	I	B
It is recommended to expedite delivery in women with pre-eclampsia associated with adverse markers such as haemostatic disorders.	I	C
In women with gestational hypertension, delivery is recommended at 39 weeks.	I	B
Ambulatory BP or home BP monitoring should be considered to exclude white-coat and masked hypertension, which are common in pregnancy.	IIa	C
Home BP monitoring may be considered as an adjunct to office BP measurements in pregnant women to detect new-onset hypertension or for monitoring BP control.	IIb	B

Figure 13

Arrhythmogenesis in pregnant women

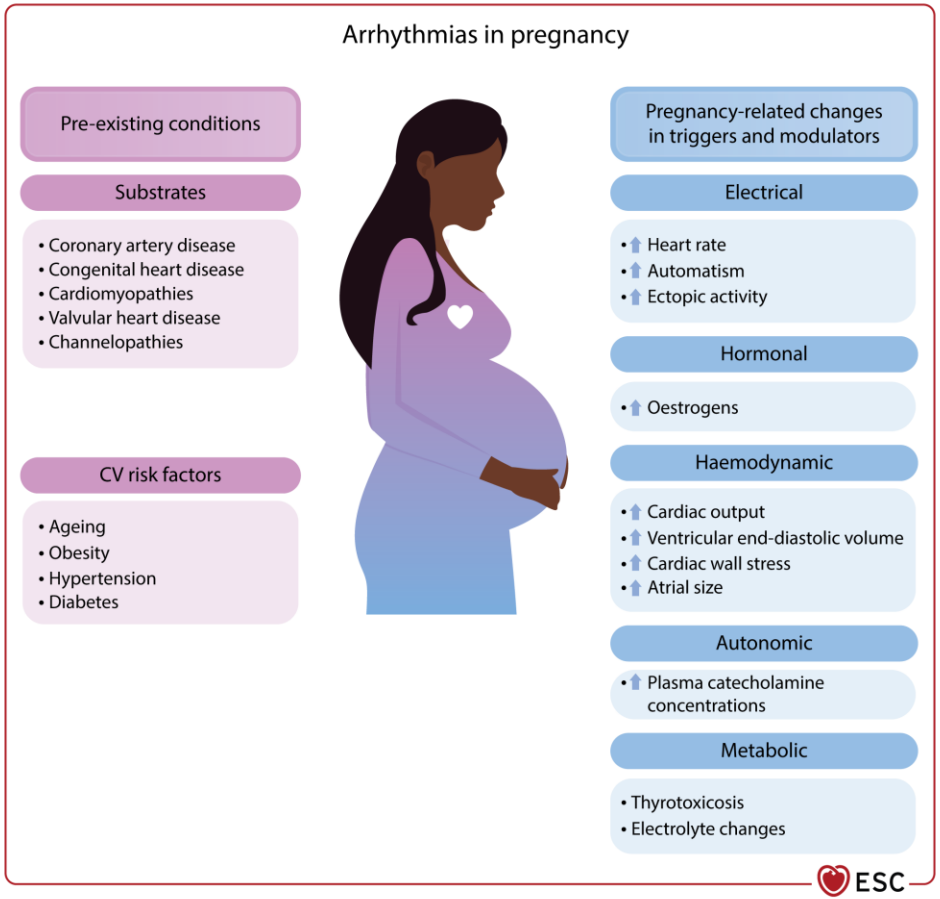


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Figure 14

Management of narrow QRS tachycardia in pregnant women

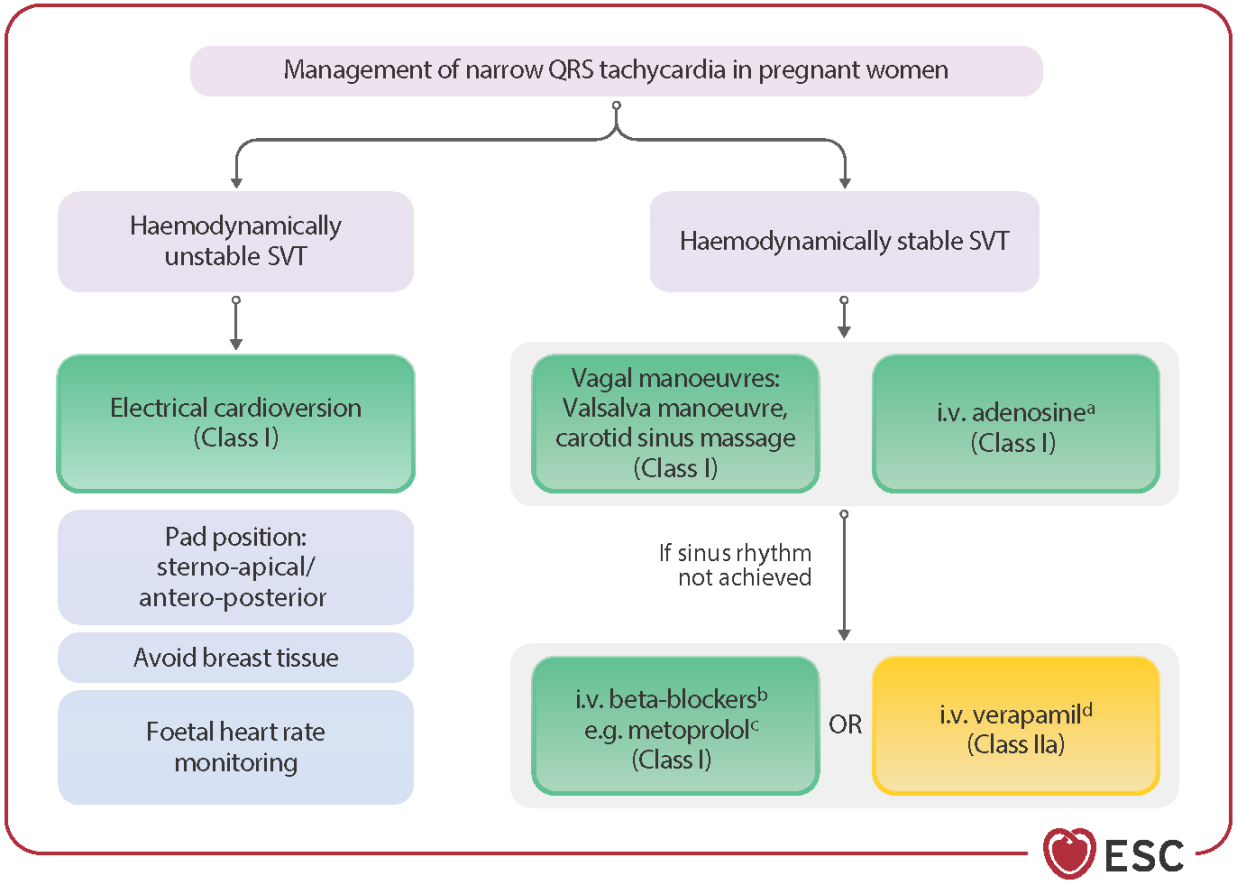

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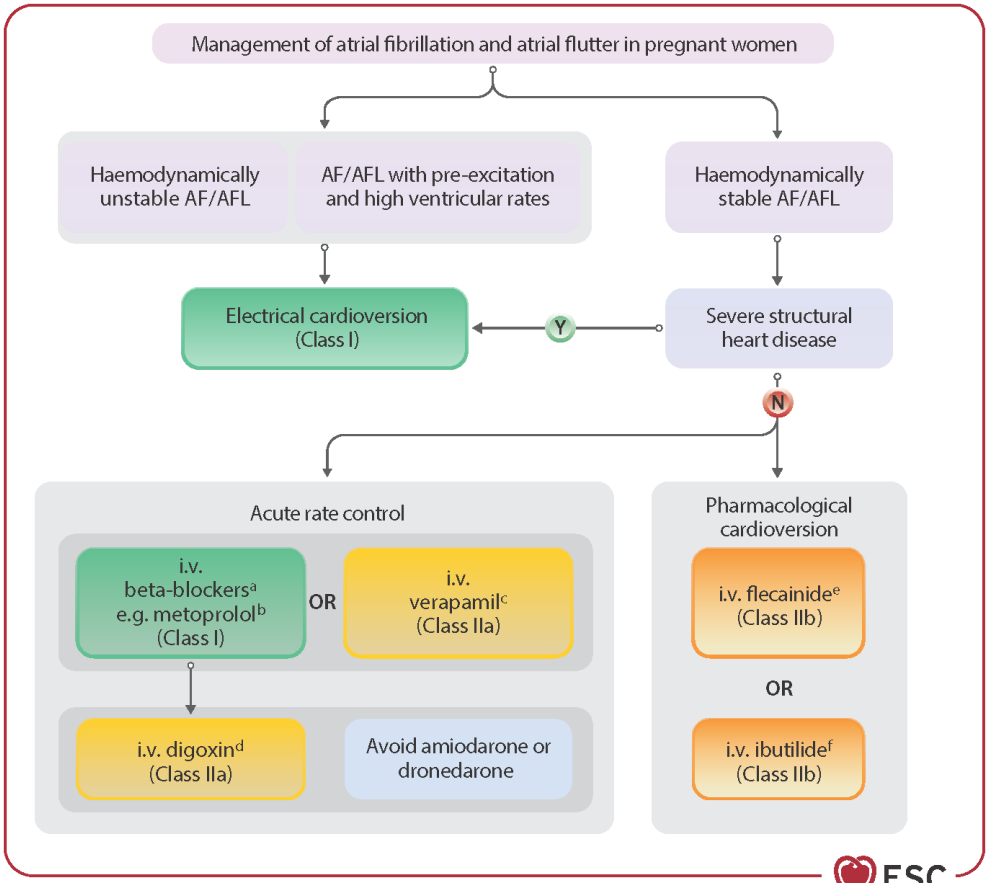
Figure 15

Management of atrial fibrillation and atrial flutter in pregnancy



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Recommendations for supraventricular tachycardia and pregnancy (1)

Recommendations	Class	Level
Acute management of SVT and AF		
Immediate electrical cardioversion is recommended for acute treatment of SVT with haemodynamic instability.	I	C
Vagal manoeuvres and i.v. adenosine are recommended for conversion of haemodynamically stable supraventricular tachycardias.	I	C
Intravenous beta-blockers (e.g. metoprolol) are recommended as the first-line option for acute rate control in pregnant women with AF or AF with preserved LVEF and rapid ventricular rate.	I	C
Intravenous digoxin or verapamil (if preserved LVEF) should be considered as a second-line option for initial rate control in pregnant women with AF or AFL and rapid ventricular rate.	IIa	C
Ibutilide or flecainide may be considered for termination of AF and AFL in pregnant women without structural heart disease.	IIb	C

Recommendations for supraventricular tachycardia and pregnancy (2)

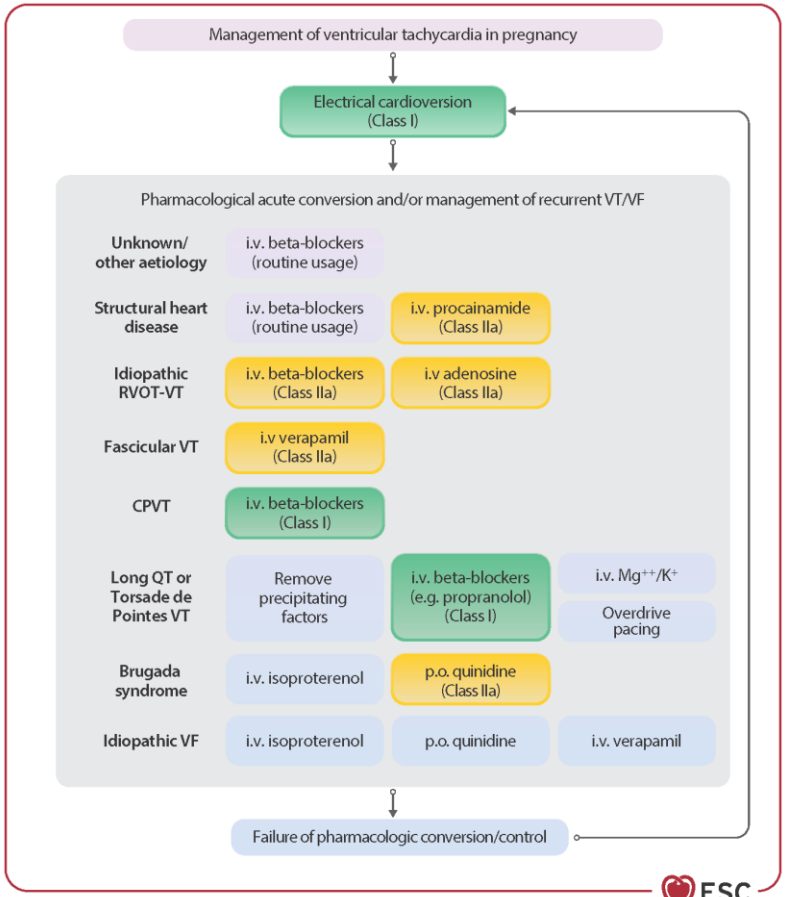
Recommendations	Class	Level
Long-term management of SVT and AF		
Therapeutic anticoagulation with LMWH is recommended for pregnant women with persistent or permanent AF at elevated thromboembolic risk.	I	C
Beta-1-selective blockers are recommended for rate control in pregnant women with AF, AFL, or FAT.	I	C
Beta-1-selective blockers or verapamil are recommended for the prevention of SVT in women without pre-excitation on resting ECG.	I	C
Flecainide or propafenone are recommended for the prevention of arrhythmias in pregnant women with WPW syndrome.	I	C
Digoxin or verapamil should be considered for rate control in pregnant women with AF, AFL, or FAT when beta-blockers fail or are not tolerated.	IIa	C

Recommendations for supraventricular tachycardia and pregnancy (3)

Recommendations	Class	Level
Long-term management of SVT and AF cont.		
Flecainide, in addition to beta-blockers, should be considered for long-term AF rhythm control in pregnancy.	IIa	C
Sotalol may be considered for rhythm management of AF and AFL with controlling for proarrhythmic risk factors as in non-pregnant women.	IIb	C
Catheter ablation may be considered in pregnant women with recurrent, long symptomatic SVT or with contraindications to pharmacological therapies.	IIb	C

Figure 16

Management of ventricular tachycardias in pregnancy



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Recommendations for ventricular tachycardia, device implantation, catheter ablation, and pregnancy

Recommendations	Class	Level
Immediate electrical cardioversion is recommended for both unstable and stable ventricular tachycardias.	I	C
Beta-blockers or verapamil are recommended for the prevention of idiopathic sustained VT.	I	C
If an ICD, pacemaker, or resynchronization therapy device is indicated during pregnancy, implantation is recommended with optimal radiation protection.	I	C
In idiopathic RVOT-VT, flecainide should be considered if beta-blockers fail, to prevent recurrence.	IIa	C
For acute conversion of haemodynamically stable sustained VTs during pregnancy, i.v. beta-blocker, adenosine (idiopathic RVOT-VT), verapamil (fascicular VT), procainamide, or overdrive ventricular pacing (ICD lead) should be considered.	IIa	C
When performing catheter ablation during pregnancy, the use of non-fluoroscopic mapping and navigation systems should be considered.	IIa	C
Catheter ablation with electro-anatomical mapping systems may be considered in experienced centres in the case of sustained drug-refractory, recurrent, and/or poorly tolerated VT if there are no other alternatives.	IIb	C

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Figure 17

Management of pacemaker and implantable cardioverter defibrillator and pregnancy

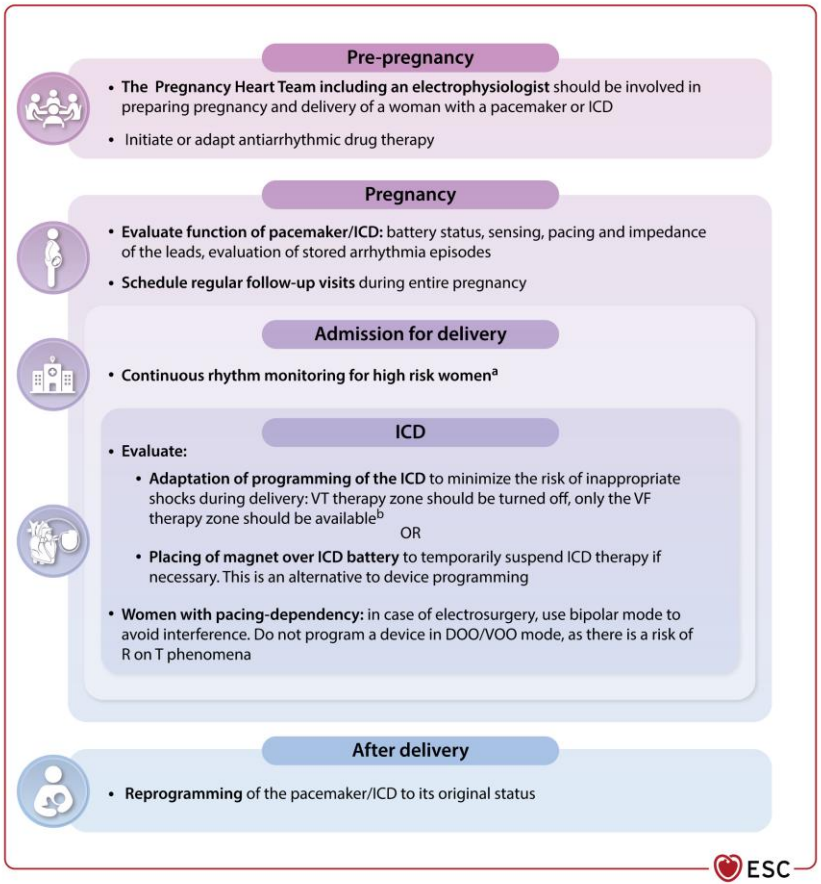

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Figure 18

Management of implantable cardioverter defibrillator shocks in pregnancy

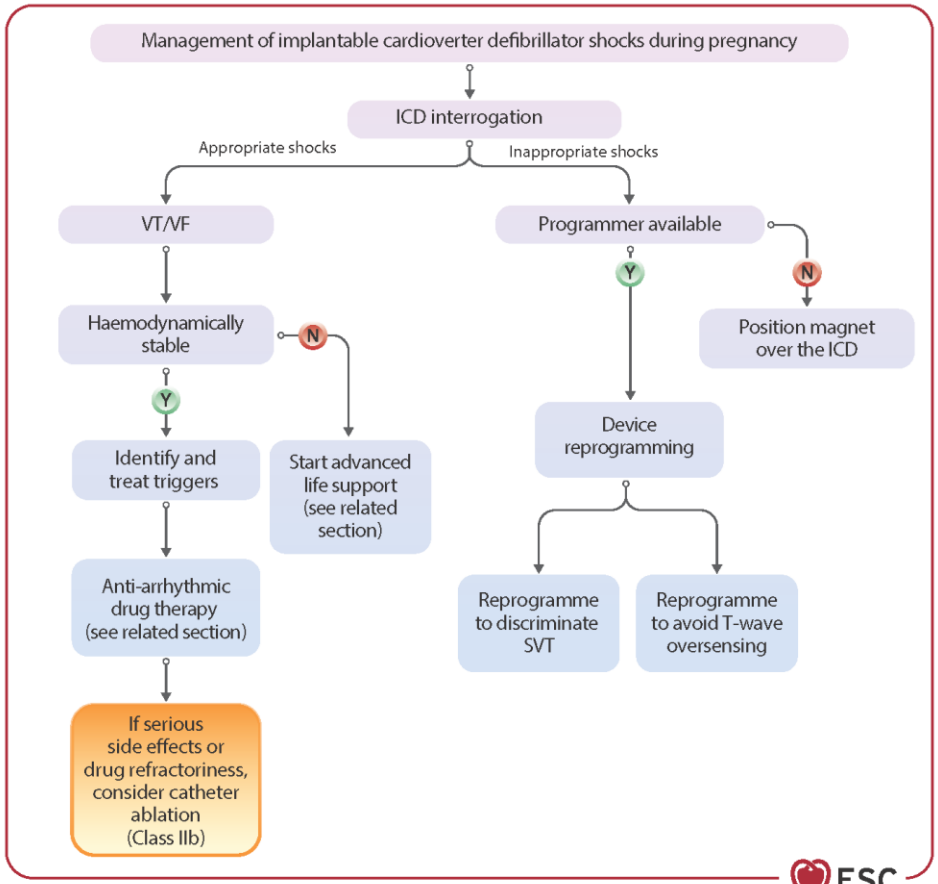

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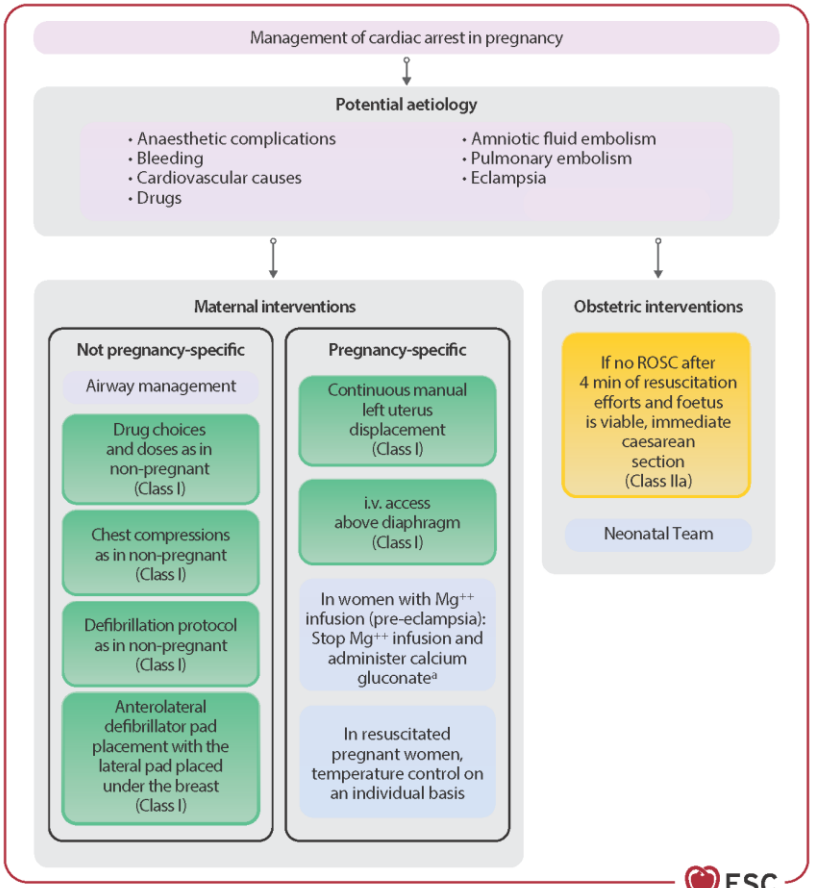
Figure 19

Management of cardiac arrest in pregnancy



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Recommendations for cardiac arrest and pregnancy

Recommendations	Class	Level
Continuous manual left uterine displacement during CPR in pregnant women (≥20 weeks) with cardiac arrest is recommended to relieve aortocaval compression.	I	C
It is recommended to establish i.v. access above the diaphragm to ensure that the i.v. therapy is not obstructed by the gravid uterus.	I	C
It is recommended to perform the same chest compressions and defibrillation protocols in pregnant as in non-pregnant women.	I	C
Anterolateral defibrillator pad placement is recommended with the lateral pad placed under the breast.	I	C
It is recommended that no drugs are withheld in pregnant women with cardiac arrest due to concerns of teratogenicity.	I	C
Immediate caesarean section at the site of the arrest should be considered and immediately prepared if ROSC has not been achieved in the mother after 4 minutes of resuscitative efforts and if the foetus is viable, taking gestational age, comorbidities, and the available level of medical care into account.	IIa	C

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Recommendation for congenital atrioventricular block and pregnancy

Recommendations	Class	Level
In pregnant women with asymptomatic congenital AV block, normal cardiac anatomy and function, a narrow QRS complex, and ventricular rate (≥50 b.p.m.), a prophylactic temporary pacemaker during delivery is not recommended.	III	C

Recommendations for native valve disease and pregnancy (1)

Recommendations	Class	Level
Intervention is recommended before pregnancy in symptomatic patients with severe aortic stenosis.	I	C
Intervention is recommended before pregnancy in women with mitral stenosis and a valve area <1.5 cm^2.	I	C
In pregnant women with symptomatic mitral stenosis or pulmonary hypertension, restricted activities and beta-blockers are recommended.	I	C
In pregnant women with mitral stenosis, diuretics are recommended when congestive symptoms persist despite beta-blockers.	I	C
Full therapeutic-dose anticoagulation is recommended in women with mitral stenosis complicated by AF, left atrial thrombus, or prior embolism.	I	C
Surgical treatment is recommended before pregnancy in women with severe aortic or mitral regurgitation with symptoms, impaired ventricular function, or marked ventricular dilatation.	I	C

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Recommendations for native valve disease and pregnancy (2)

Recommendations	Class	Level
Diuretics are recommended in pregnant women with regurgitant lesions when symptoms or signs of congestion occur.	I	C
Intervention should be considered before pregnancy in those with asymptomatic severe aortic stenosis after counselling on the risks and benefits.	IIa	C
Percutaneous mitral commissurotomy for mitral stenosis should be considered in pregnant women with severe symptoms or systolic pulmonary artery pressure >50 mmHg despite medical therapy.	IIa	C
Valve surgery during pregnancy should only be considered when there is a maternal mortality risk and other treatment options have failed.	IIa	C
In very selected symptomatic pregnant women with severe aortic stenosis not responding to medical therapy, non-surgical options such as balloon valvuloplasty or TAVI may be considered.	IIb	C

Figure 20

Valvular heart disease and pregnancy

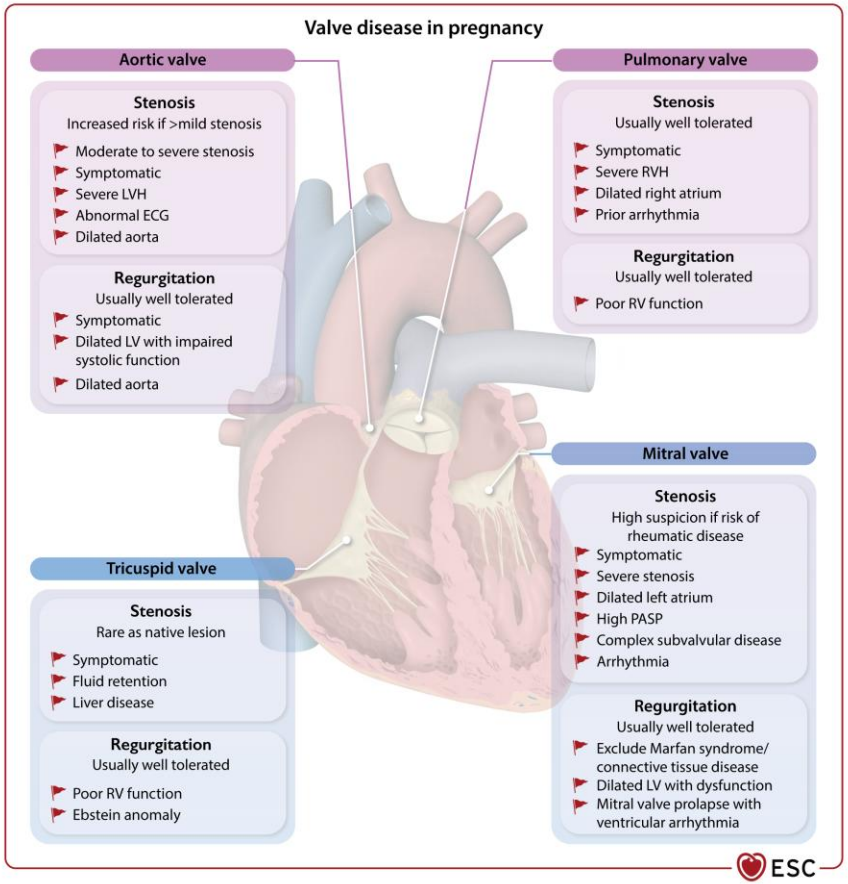

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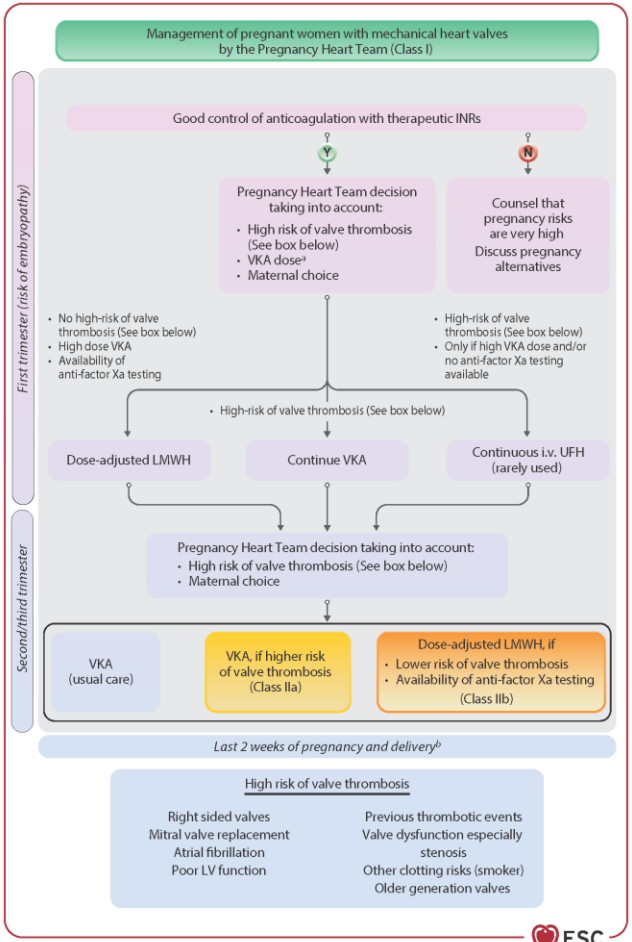
Figure 21

Management of anticoagulants during the different stages of pregnancy in women with mechanical heart valves



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Recommendations for prosthetic valves and pregnancy (1)

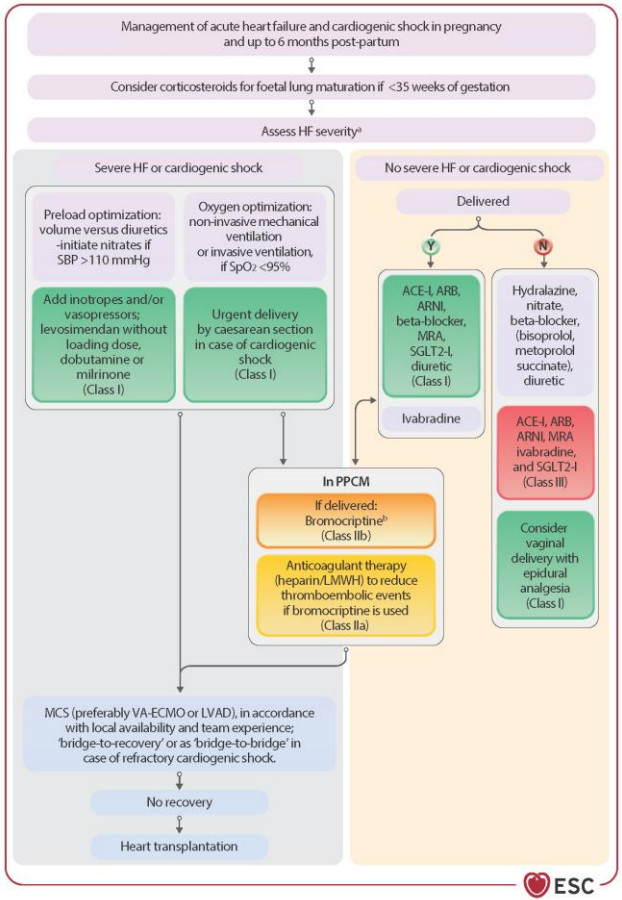
Recommendations	Class	Level
A bioprosthetic valve is recommended (over a mechanical valve) in young women contemplating pregnancy requiring a valve prosthesis.	I	B
It is recommended that the type of valve surgery or intervention for a woman contemplating pregnancy is chosen in consultation with the Pregnancy Heart Team.	I	C
Women with mechanical heart valves		
It is recommended that a care plan documenting the agreed anticoagulant strategy (including the decision to continue VKAs or converting to therapeutic-dose LMWH in the first trimester) is in place for women of childbearing age with a MHV prior to pregnancy or as soon as pregnancy is recognized.	I	C
It is recommended that pregnant women with a MHV are managed by the Pregnancy Heart Team.	I	C
In pregnant women on VKAs, it is recommended to perform INR monitoring weekly or at a minimum every 2 weeks.	I	C

Recommendations for prosthetic valves and pregnancy (2)

Recommendations	Class	Level
Women with mechanical heart valves cont.		
In pregnant women with MHVs on therapeutic-dose LMWH, it is recommended to check peak anti-factor Xa levels and to target levels according to individualized risk.	I	C
During the second and third trimesters until the 36th week, continuing VKAs should be considered in women with prosthetic heart valves at higher risk of thrombosis.	IIa	C
During the second and third trimesters, continuing LMWH with anti-factor Xa level monitoring and dose adjustment may be considered in women at lower risk of thrombosis.	IIb	C
LMWH is not recommended when anti-factor Xa level monitoring is not available.	III	C

Figure 22

Management of acute heart failure and cardiogenic shock in pregnancy and up to 6 months post-partum



Recommendations for chronic and acute heart failure and pregnancy (1)

Recommendations	Class	Level
Chronic HF		
It is recommended that women with HFrEF are advised about the risk of deterioration of cardiac function during pregnancy and peripartum.	I	C
In pregnant women with HFrEF, it is recommended that non-selective beta-blockers are switched to beta-1-selective blockers (metoprolol, bisoprolol) with close maternal and foetal monitoring.	I	C
Anticoagulation with therapeutic doses of LMWH is recommended in pregnant women with intracardiac thrombus or decreased LV function with EF <35%.	I	C
It is recommended to optimize HF guideline-directed medical therapy after delivery, taking contraindicated drugs during lactation into account[c].	I	C
Due to the high metabolic demands of lactation, avoiding lactation may be considered in women with severe HF.	IIb	C
ACE-Is, ARBs, ARNIs, MRAs, ivabradine, and SGLT2 inhibitors are not recommended during pregnancy due to adverse foetal effects.	III	C

Recommendations for chronic and acute heart failure and pregnancy (2)

Recommendations	Class	Level
Acute HF		
Inotropes and/or vasopressors are recommended in pregnant women with cardiogenic shock with levosimendan, dobutamine, and milrinone as recommended agents.	I	C
Urgent delivery with caesarean section is recommended in pregnant women with cardiogenic shock as soon as the foetus is viable, taking gestational age, comorbidities, and the available level of medical care into account.	I	C
Early transfer of pregnant women in cardiogenic shock to a facility providing mechanical circulatory support should be considered.	IIa	C
Preventing lactation may be considered in women with severe HF due to the high metabolic demands of lactation.	IIb	B

Recommendations for heart transplantation and pregnancy

Recommendations	Class	Level
It is recommended to postpone pregnancy until at least 1 year after heart transplantation, taking individual risk factors into account.	I	C
In women with a heart transplant, it is recommended that immunosuppression serum drug levels are monitored during pregnancy every 4 weeks until the 32nd week, then every 2 weeks until the 36th week, then weekly until delivery, and for 6–12 months after delivery to guide dosing.	I	C
It is recommended to perform weekly monitoring of donor-specific antibodies for at least 6–12 months after delivery.	I	C
Paternal HLA testing prior to conception should be considered due to the risk of developing donor-specific antibodies.	IIa	C
Mycophenolic acid therapy is not recommended in pregnancy and should be discontinued 6 weeks before conception.	III	C

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Recommendations for cardio-oncology and pregnancy

Recommendations	Class	Level
It is recommended that pregnant women with cancer who require cardiotoxic cancer therapy are jointly managed by the Pregnancy Heart Team and the cardio-oncology team.	I	C
Cardiac troponin and NP measurements may be considered at baseline and during anthracycline chemotherapy in pregnant women with cancer.	IIb	C

Figure 23

Multidisciplinary approach of adverse pregnancy outcomes

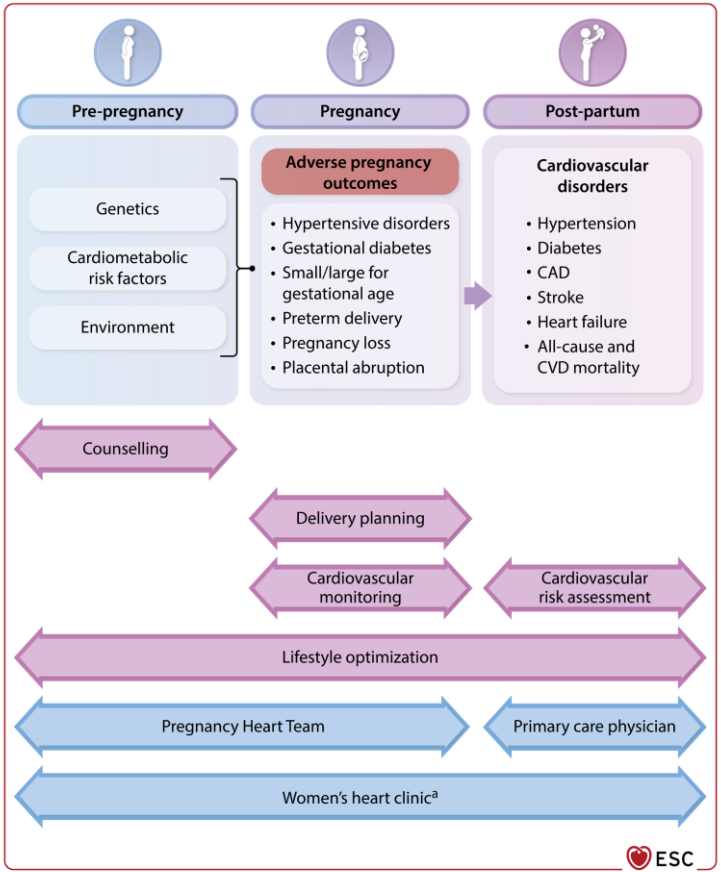

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Figure 24

Algorithm for the management of new-onset post-partum hypertension

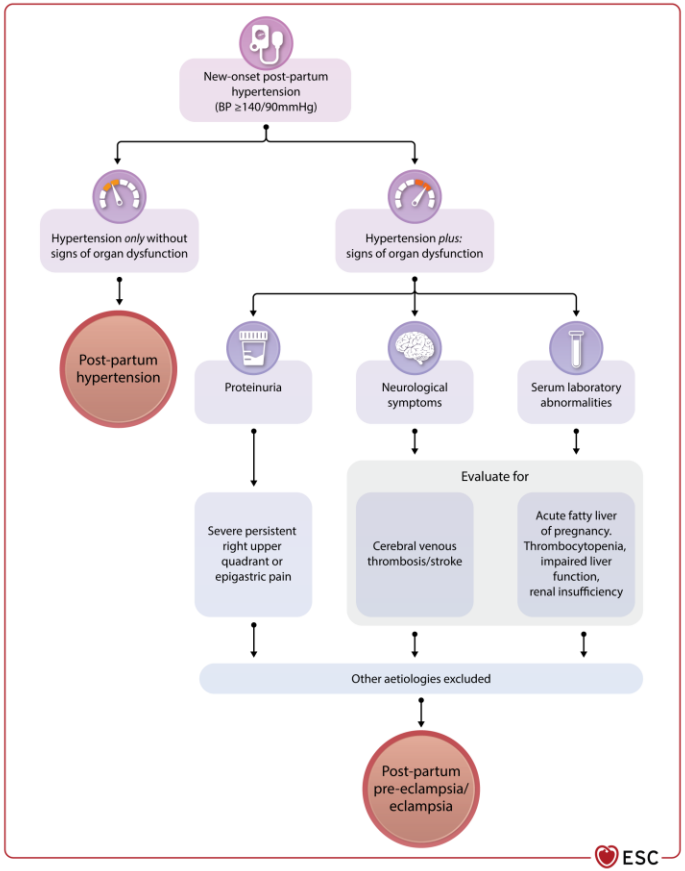

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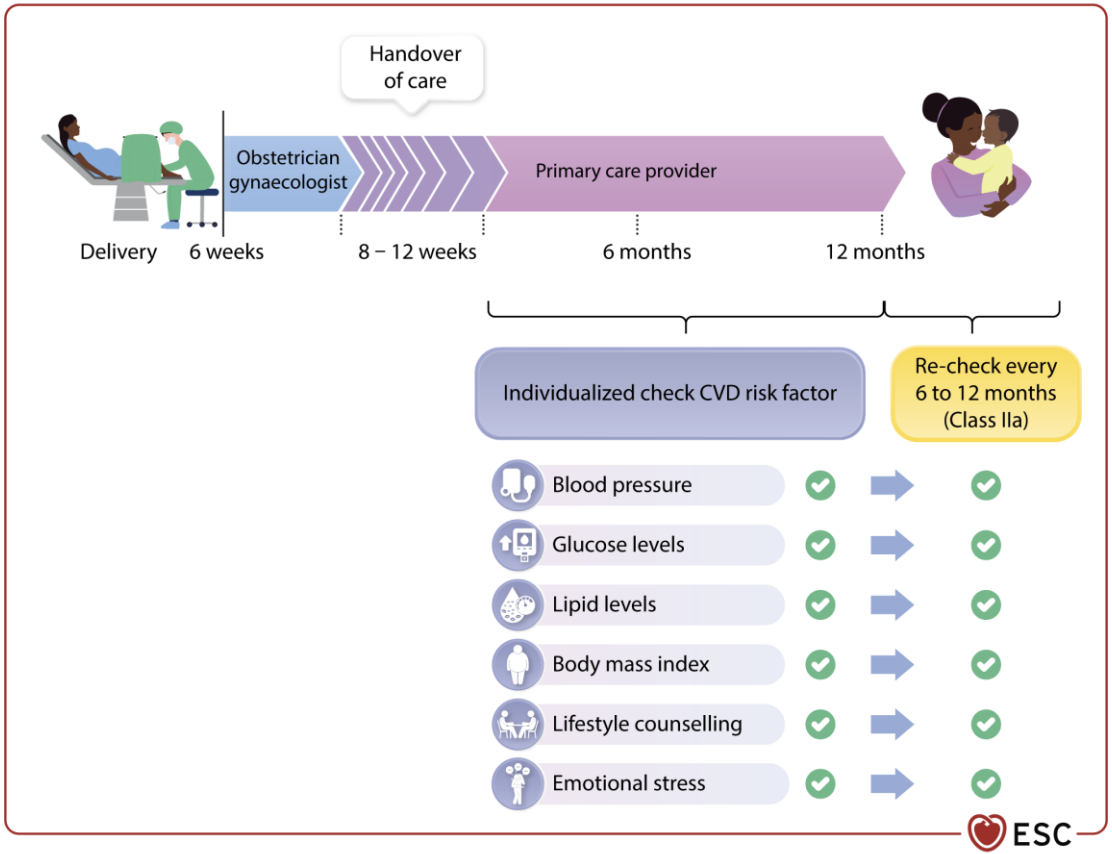
Figure 25

Algorithm for the management of adverse pregnancy outcomes



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Recommendations for long-term effects of adverse pregnancy outcomes (1)

Recommendations	Class	Level
It is recommended to undertake a cardiovascular risk assessment in women with APOs, to recognize and document APOs when CVD risk is evaluated in women, and to provide counselling on the importance of healthy lifestyle choices that optimize cardiovascular health.	I	B
In women with persistent post-partum hypertension beyond 6 weeks to 3 months post-partum, initiation of antihypertensive therapy with reference to lactating status is recommended following current guidelines.	I	B
In cases where adoption of healthy lifestyle choices alone is inadequate to control post-partum glucose levels, initiation of pharmacotherapy following current guidelines is recommended.	I	C
It is recommended that women with a history of GDM undergo a formal oGTT 6–12 weeks post-partum with a repeat assessment at 6–12 months and regular annual follow-up visits to screen for diabetes.	I	C

Recommendations for long-term effects of adverse pregnancy outcomes (2)

Recommendations	Class	Level
Nifedipine and labetalol (metoprolol if labetalol is unavailable) are recommended as treatments for uncomplicated post-partum hypertension in the first 6 weeks after delivery.	I	C
In women with a history of any APO, cardiovascular risk assessment should be considered at 3 months post-partum with repeat assessment at 6–12 months after implementation of appropriate lifestyle interventions, and regular long-term follow-up thereafter.	IIa	C
Breastfeeding may be considered in order to lower the future cardiovascular risk in women with APOs.	IIb	C

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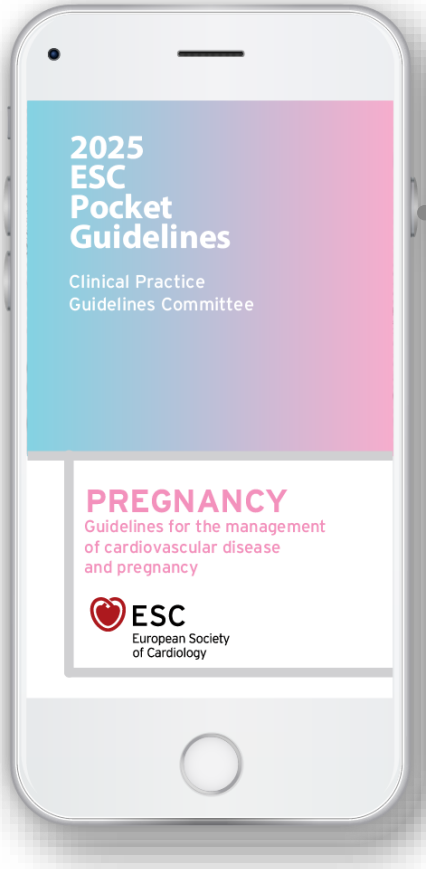

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