Attachment 1: Tables and schemes

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Table 1: Evidence based recommendations: basic monitoring

Basic monitoring	Evidence grade	Grade of recommendation
For continuous ECG-monitoring for the diagnosis of arrhythmias and ischemia leads II and V5, or alternatively II and V3, or II and V4, or when technologically possible V3, V4 and V5 should be used.	C	A
ST-segment monitoring can be used with any ECG monitoring.	D	0
For intensive care patients a 12 channel ECG on admission and daily for the first three post operative days of ICU stay might be documented. After the 3rd day of ICU treatment, the indication depends on the individual clinical situation.	D	B
Continuous monitoring with pulse oximetry detects clinically inapparent O_2-desaturations and should therefore be used as continuous monitoring method.	A	A
Continuous invasive blood pressure monitoring should be obligatory following cardiac surgery, as non-invasive measurement is discontinuous and too imprecise.	B	A
The CVP can, despite methodological limitations, provide important information regarding acute changes in right ventricular compliance and/or the volume status and thus might be measured continuously.	D	B
Temperature might be measured continuously. If measured discontinuously, it might be taken and recorded 4 hourly.	D	B
The fluid balance might be recorded hourly for the first 24 hours, thereafter dependent on the clinical status of the patient, 4 hourly.	D	B
An ABG might be taken within 30 minutes of admission to the ICU, or during a period of cardiopulmonary instability or following a change in the ventilation setting. When the FiO_2 is ≥ 0.6 an AGB might be done 4 hourly, otherwise, it is recommended at least 8 hourly.	D	B
$ScvO_2$ appropriately tracks the course of SvO_2 and can be used as an alternative. However, it should be borne in mind that a normal $ScvO_2$ is not necessarily proof for a normal SvO_2.	D	0

Table 2: Evidence based recommendations for advanced haemodynamic monitoring: echocardiography

Advanced hemodynamic monitoring: echocardiography	Evidence grade	Grade of recommendation
In patients who show acute persistent hemodynamic disturbances, do not respond to initial therapies, and demonstrate unclear ventricular dysfunction and determinants thereof, echocardiography is recommende for establishing diagnosis in the perioperative period and improves clinical outcome.	D	B
In comparison with TTE, TEE has diagnostic advantages particularly in ventilated post operative patients and can be used preferentially in this patient group.	D	0
Use of TEE in the perioperative period can improve clinical outcome in patients at increased risk of myocardial ischemia or infarction.	D	0
Assessing cardiac output with echocardiography using the Doppler method is just as reliable as the thermodilution techniques and is recommended to be used as an alternative to measuring CO discontinuously.	B	B
The TTE or TEE examination should be documented.	D	A

Table 3: Evidence based recommendations: extended hemodynamic monitoring: transpulmonary thermodilution and pulse contour analysis

Extended hemodynamic monitoring: transpulmonary thermodilution and pulse contour analysis	Evidence grade	Grade of recommendation
The pulse contour analysis in post operative cardiac surgery patients (CABG) shows good correlation with the gold standard method of pulmonary arterial thermodilution and might be used for extended hemodynamic monitoring.	C	B
The measurement of ITBV seems to be superior to the CVP and the PAOP from the PAC for the appraisal of cardiac preload.	C	0
When taking into account the methodologically intrinsic limitations, the parameters stroke volume variation (SVV) and pulse pressure variation (PPV) are superior to the central venous pressure (CVP) and the pulmonary artery occlusion pressure (PAOP) for predicting volume responsiveness. SVV and PPV therefore might be used as helpful supplement to hemodynamic diagnostics.	C	B

Table 4: Evidence based recommendations: extended hemodynamic monitoring: pulmonary artery catheter

Extended haemodynamic monitoring: pulmonary artery catheter	Evidence grade	Grade of recommendation
The PAC in cardiac surgical patients with low perioperative risks might not be used.	C	B
The PAC can be used; • for determining the cause and guiding therapy in severe LCOS • for differentiating between left or right ventricular dysfunction • for diagnosis and orientation of therapy of pulmonary hypertension • in high risk cardiac surgery patients undergoing complex interventions	D	0

Abbreviation: LCOS=low cardiac output syndrome

Table 5: Evidence based recommendations: volume management

Volume management	Evidence grade	Grade of recommendation
When using crystalloid solutions balanced full electrolyte solutions can be favoured.	D	0
An advantage for hypertonic crystalloid solutions in comparison with isotonic or approximately equivalent isotonic crystalloid solutions has not been demonstrated.	A-	0
As artificial colloids, medium molecular weight HAES (6%) or succinylated gelatin can be recommended.	D	0
For volume replacement in cardiac surgical patients HAES can be used as well as human albumin. There is no scientific evidence to support the use of the more expensive albumin over medium molecular weight HAES (6%) preparations.	D	0

Table 6: Evidence based recommendations: postoperative cardiocirculatory dysfunction

Postoperative cardiovascular dysfunction	Evidence grade	Grade of recommendation
Preoperative or early postoperative administration of antiarrthymics can be performed according to existing guidelines.	D	0
For assessment of acute volume responsiveness, passive leg raising should be performed prior to volume loading.	B	A

Table 7: Evidence based recommendations: left heart failure

Left heart failure	Evidence grade	Grade of recommendation
Preload optimisation should be the basic prerequisite for medicinal or technical therapy of left heart failure.	D	A
If goals are not reached after preload optimization, therapy with positive inotropes might be indicated. The choice of substance depends on the patient's specific situation.	D	B
PDE III inhibitors can be preferred in patients who are on ß-blockers and / or those who demonstrate inadequate hemodynamic response to dobutamine.	C	C
For decreasing pre- and afterload in acute cardiac failure, treatment with nitrates might be indicated.	B	B
If vasopressors are indicated, norepinephrine should be used as the only approved vasopressor.	C	A
Dopamine for prophylaxis or therapy of renal failure is obsolete and should be not used.	A	A
The protective effects of dopexamine for the hepato-splanchnic perfusion and the increase in creatinine clearance is not proven in cardiac surgical patients. The administration of dopexamine might be not recommended.	A	B
Levosimendan can be used for prevention and / or therapy of post-CPB LCOS, especially in high-risk patients with a reduced LVEF < 30%. A continuous infusion Dose of 0.1 µg/kgKG/min with a length of infusion of 24 h is recommended. A bolus dose should not be given.	B	0

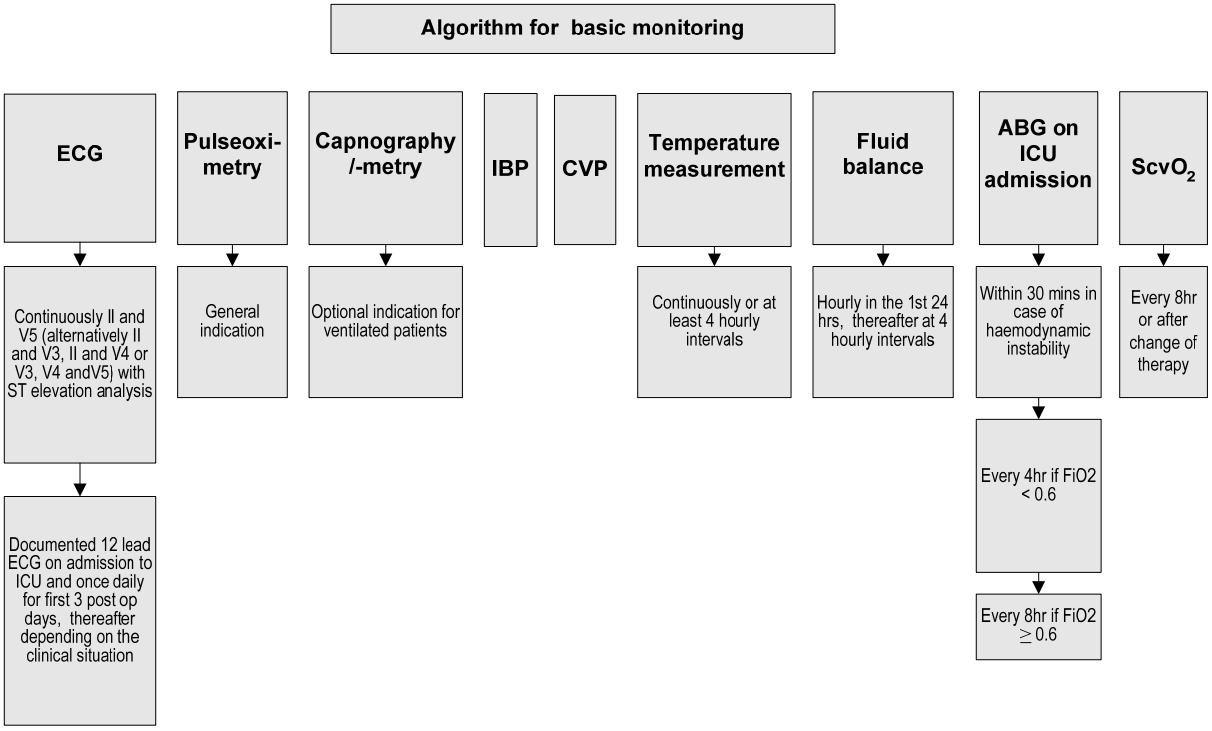
Table 8: Evidence based recommendations: right heart failure

Right heart failure	Evidence grade	Grade of recommendation
For therapy of right heart failure with adequate coronary perfusion pressure, dobutamine, PDE III inhibitor or nitroglyceride are first choice. With insufficient perfusion pressure the additional use of norepinephrine might be indicated. When this is insufficient, additional treatment with epinephrine might be considered.	D	B
Inhalative vasodilators (NO, prostanoids) might be indicated in therapy resistant right heart insufficiency.	D	B

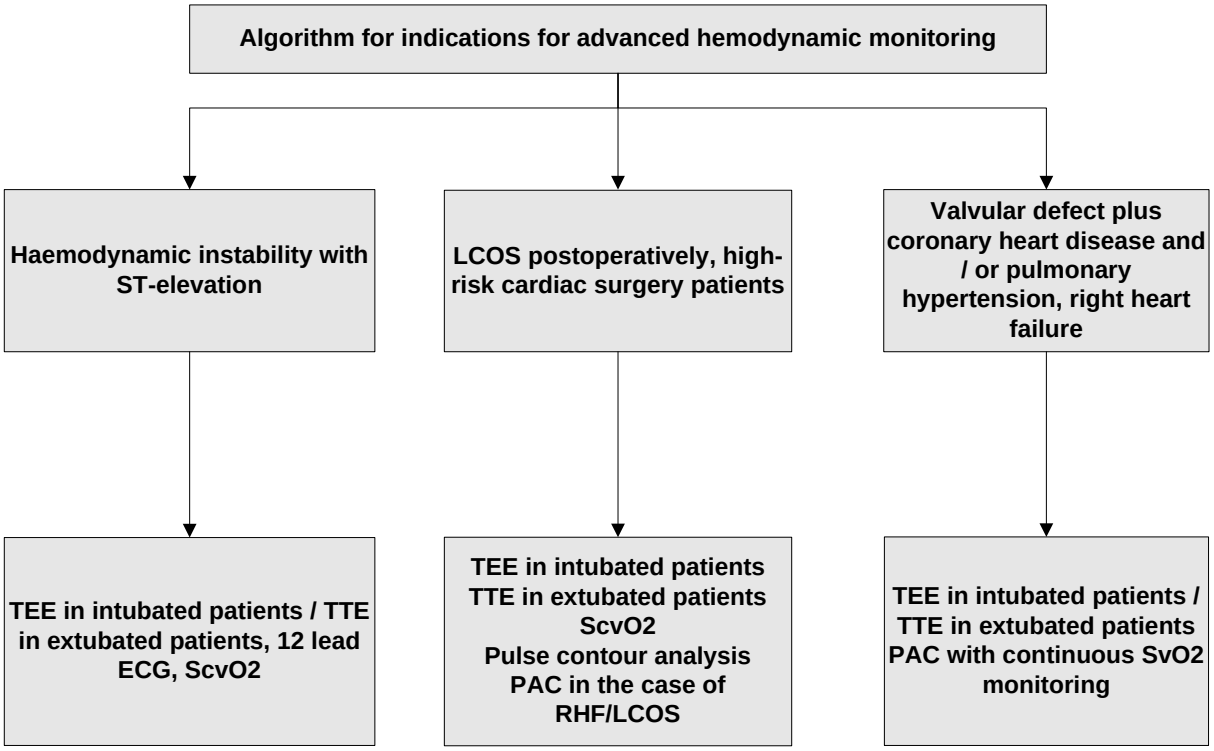
Table 9: Evidence based recommendations: Intraaotic balloon counterpulsation

IABP	Evidence grade	Grade of recommendation
The early use of IABP should be initiated when there is concomitant LCOS, an ischemia or an incomplete coronary revascularisation without the option of surgical intervention.	D	A

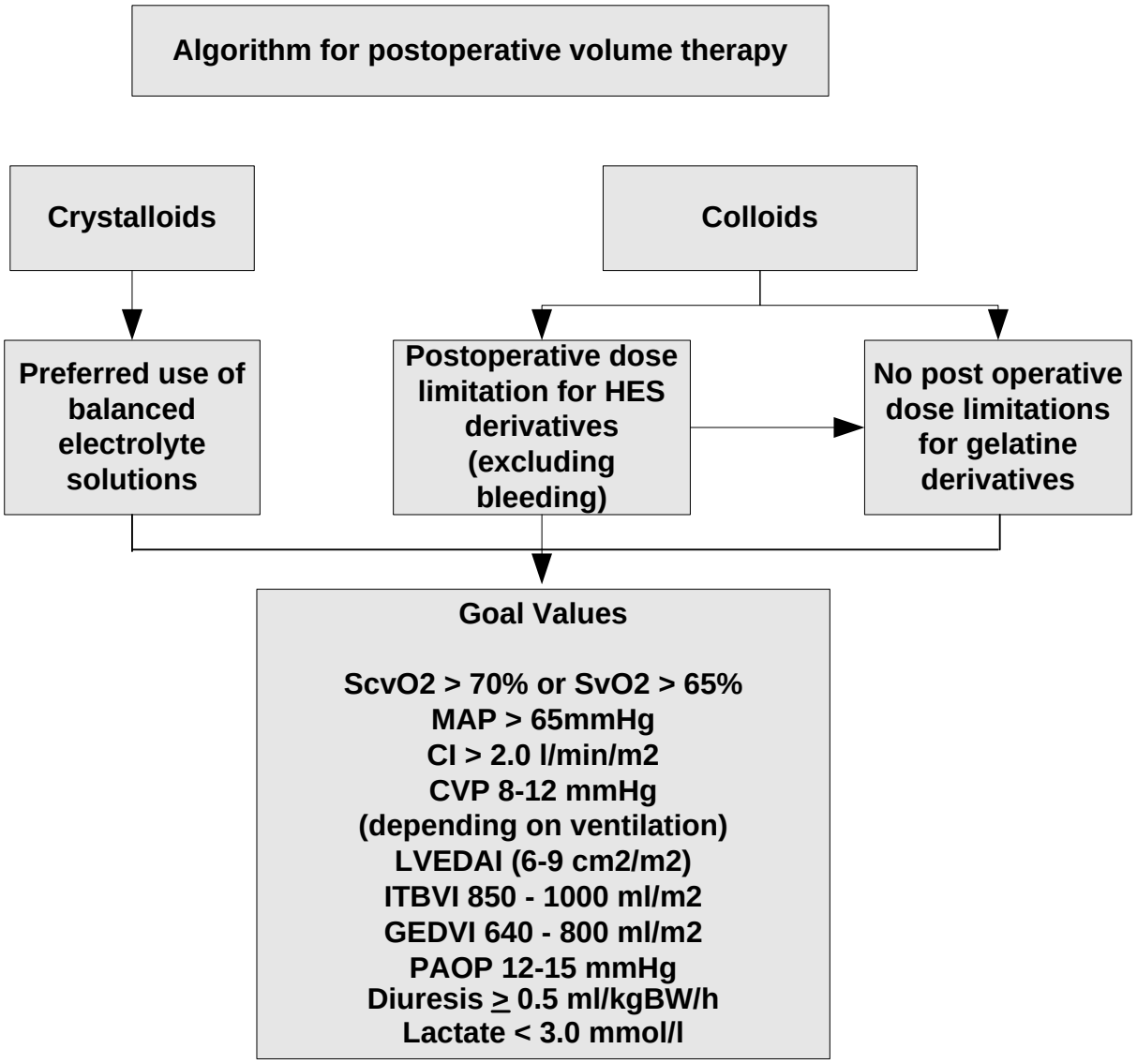
Scheme 1: Algorithm basic monitoring



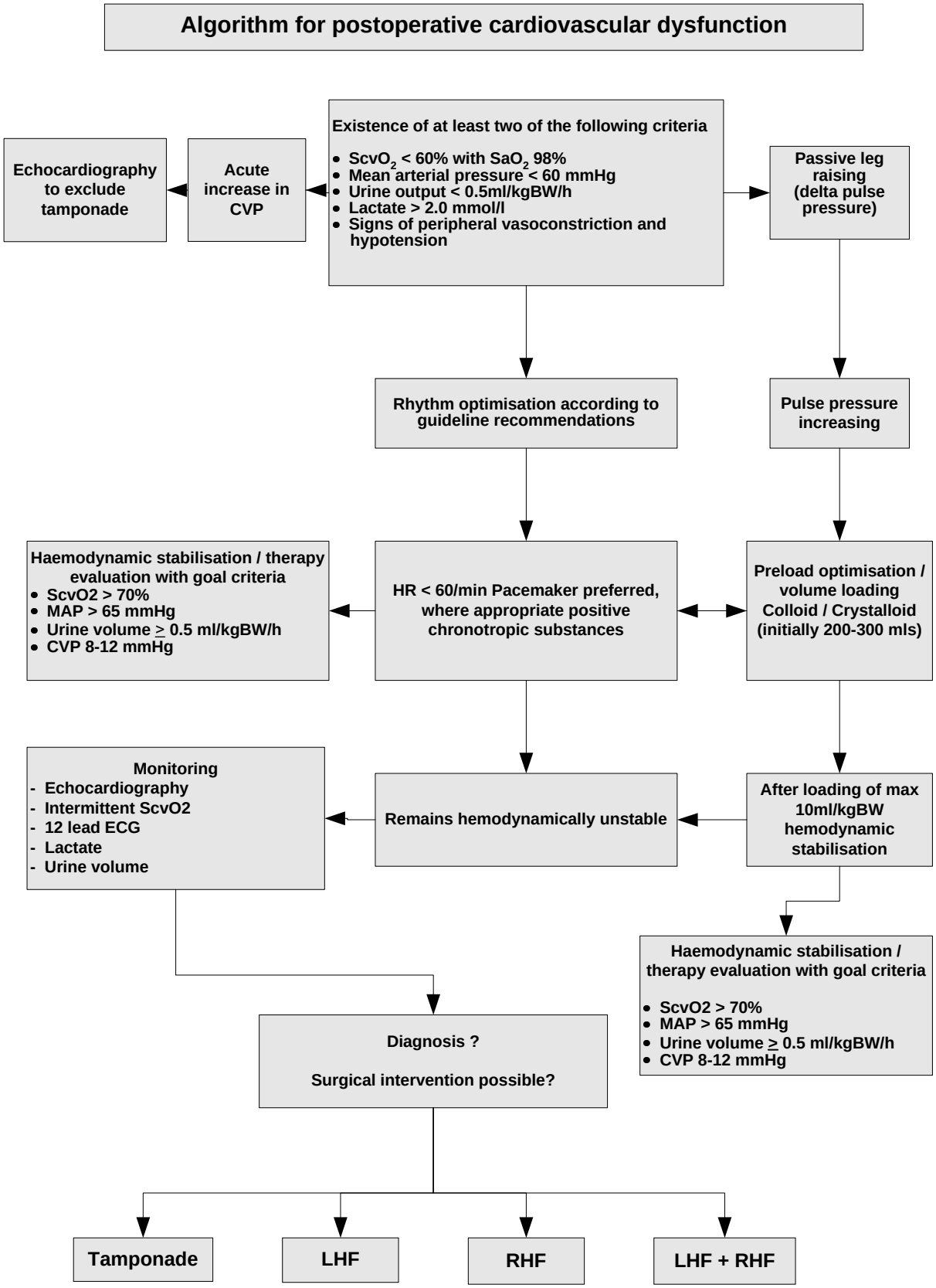
Scheme 2: Algorithm for indications of advanced hemodynamic monitoring



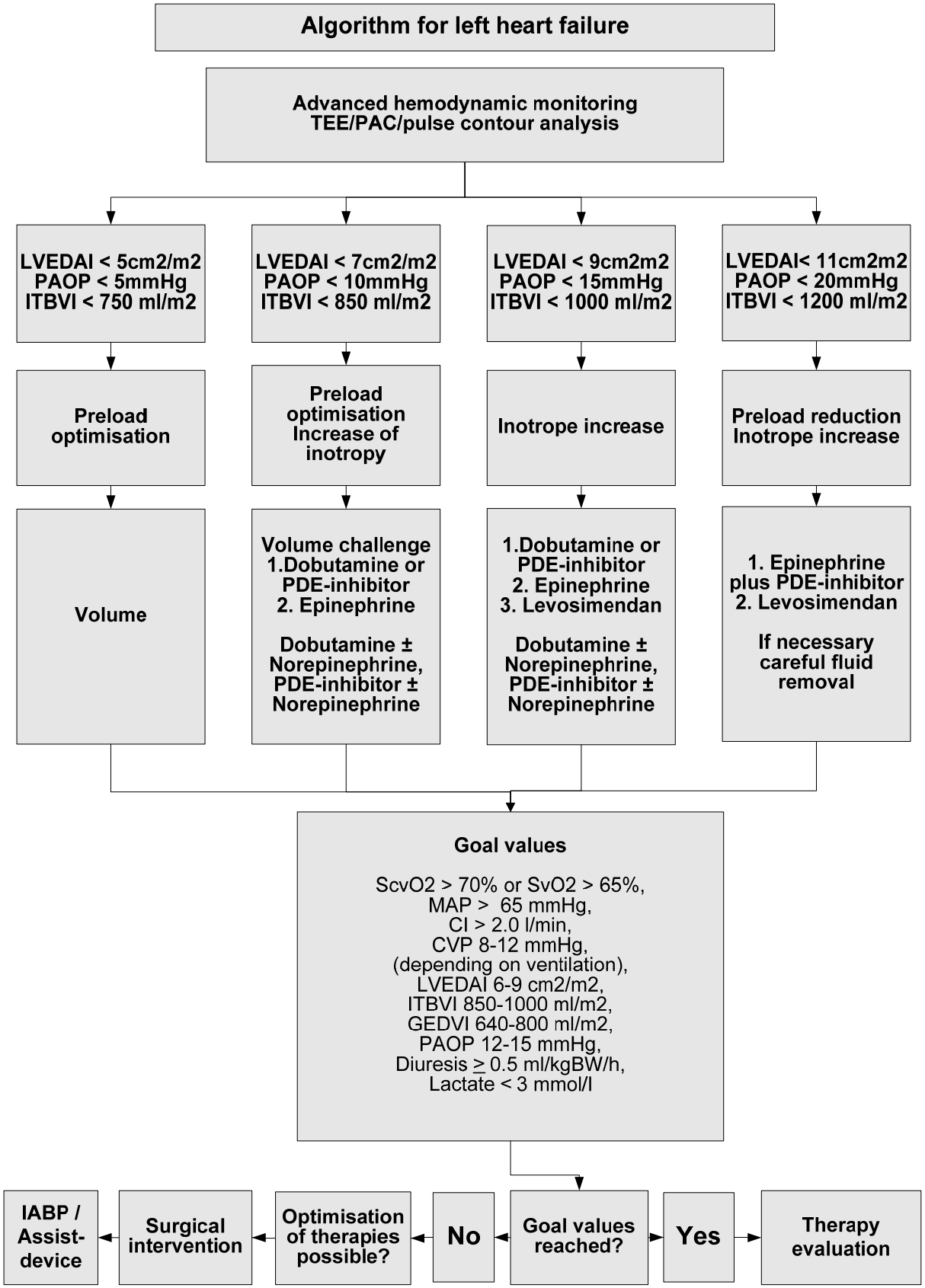
Scheme 3: Algorithm postoperative volume therapy



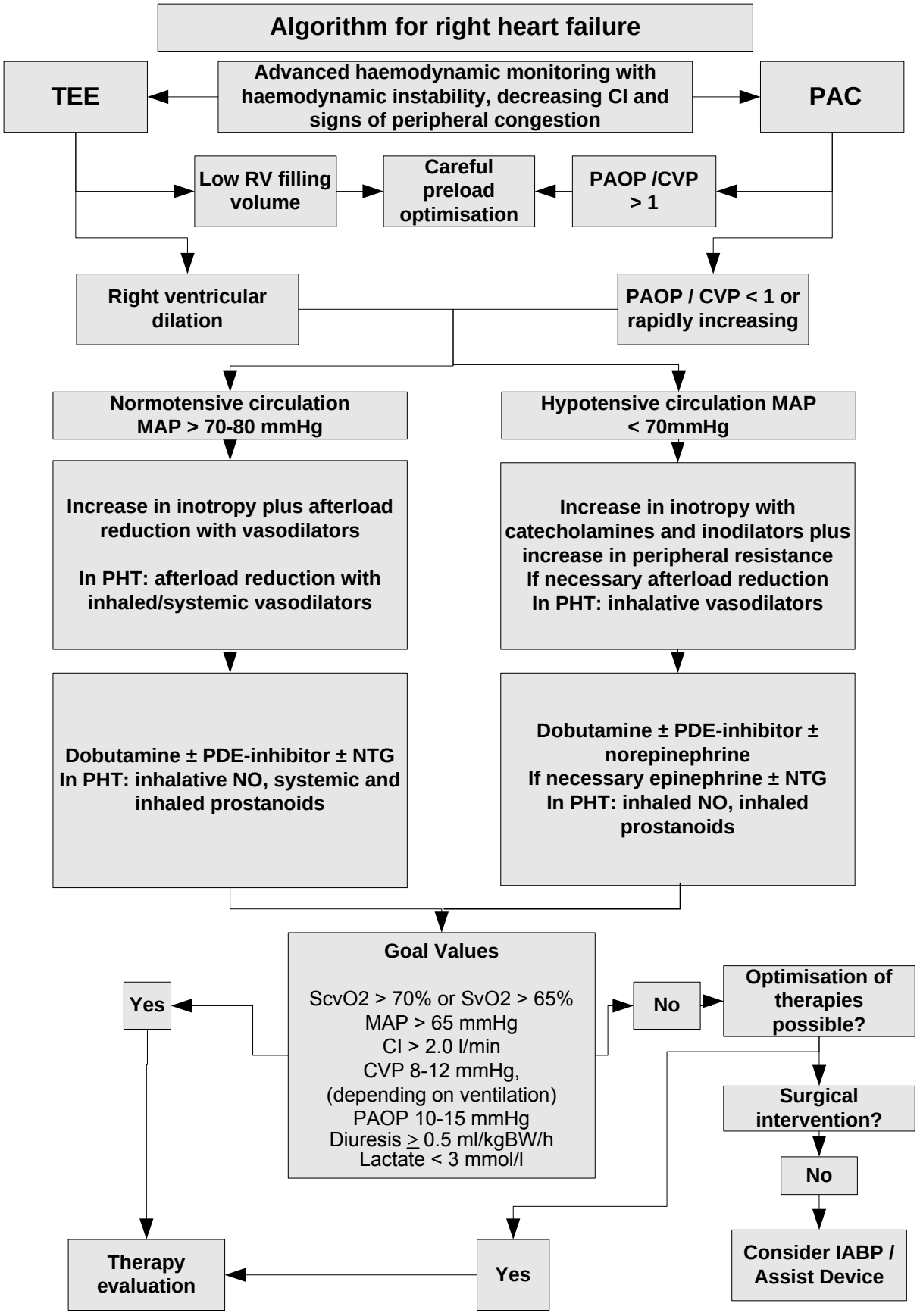
Scheme 4: Algorithm for post operative cardiocirculatory dysfunction



Scheme 5: Algorithm for left heart failure



Scheme 6: Algorithm for right heart failure



Scheme 7: Algorithm for IABP