HYPERTENSION IN CKD

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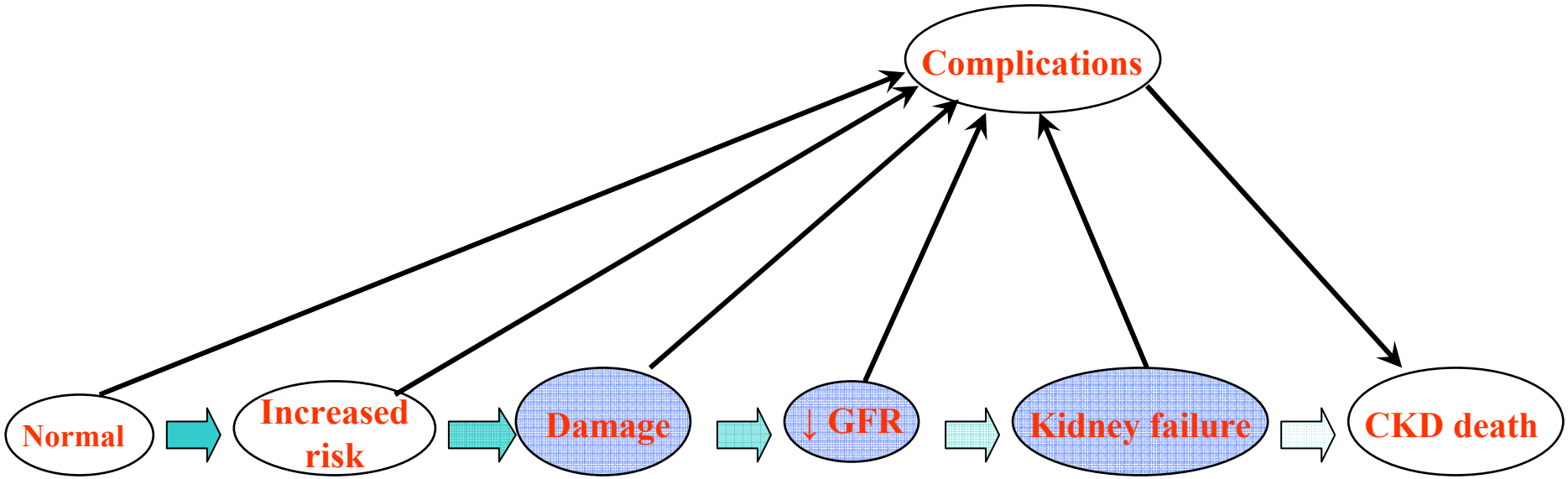
Stages in Progression of Chronic Kidney Disease and Therapeutic Strategies



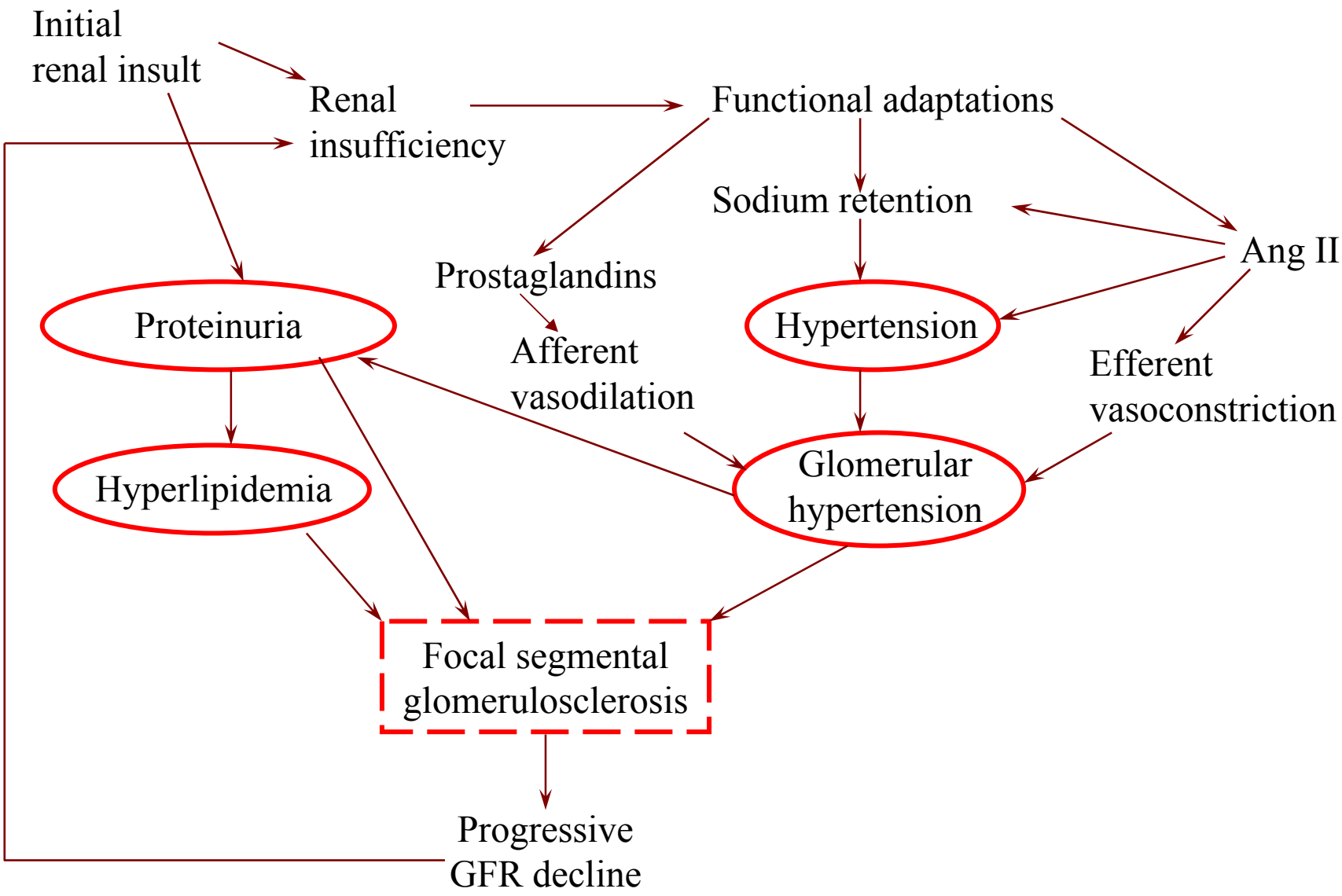
Screening for CKD risk factors

CKD risk reduction, Screening for CKD

Diagnosis & treatment, Treat comorbid conditions, Slow progression

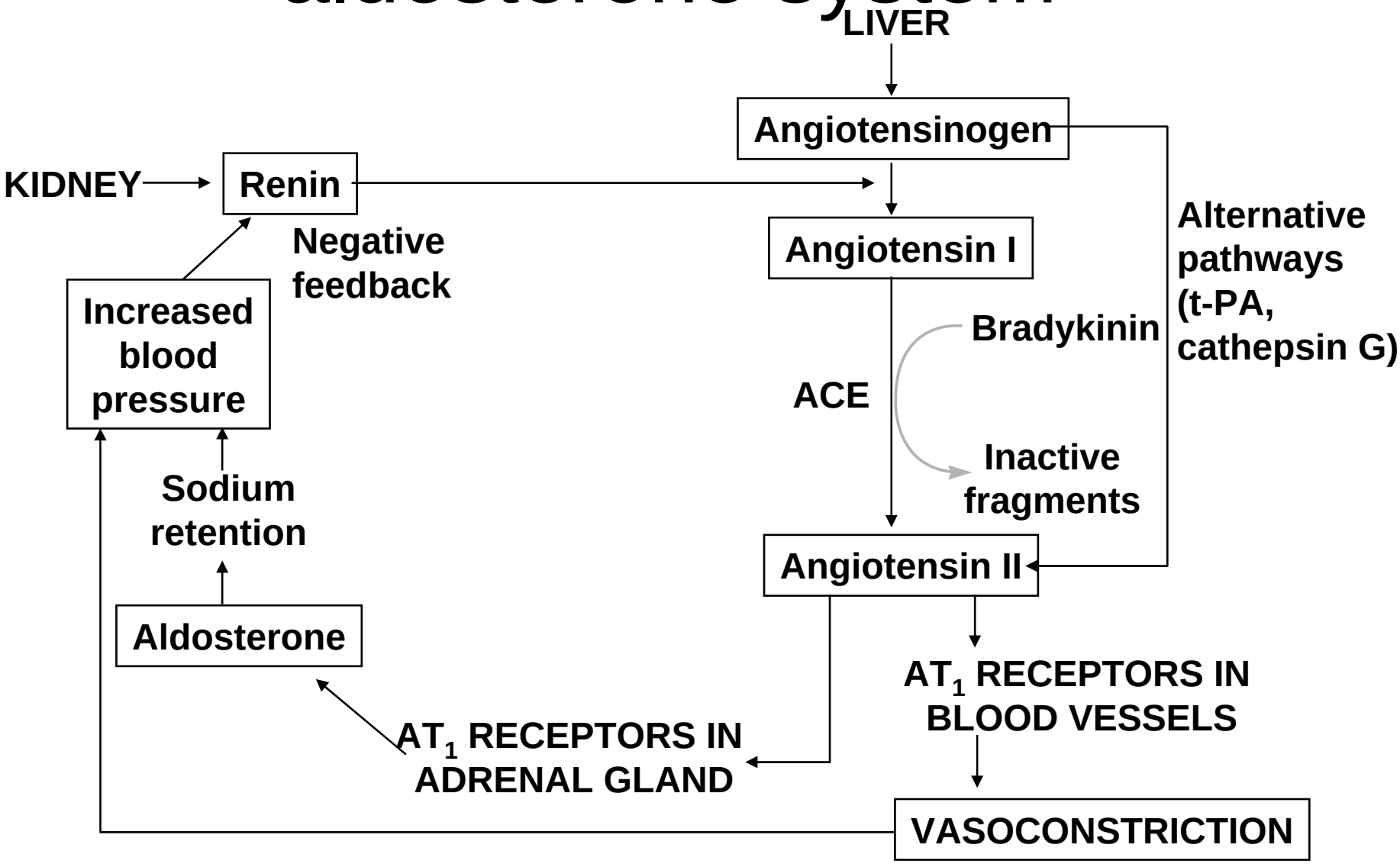
Estimate progression, Treat complications, Prepare for replacement

Replacement by dialysis & transplant

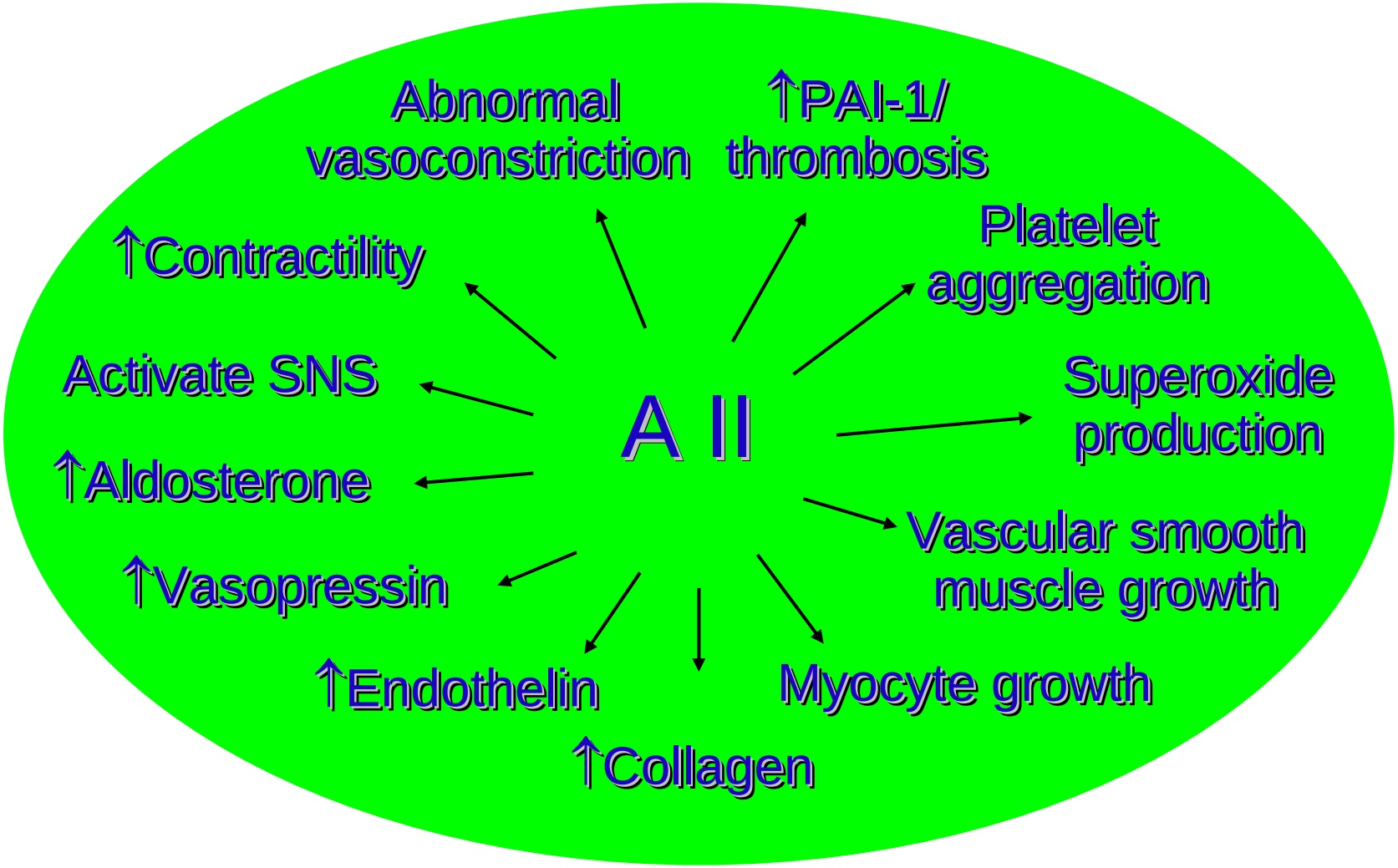


Mechanisms of progressive renal loss.

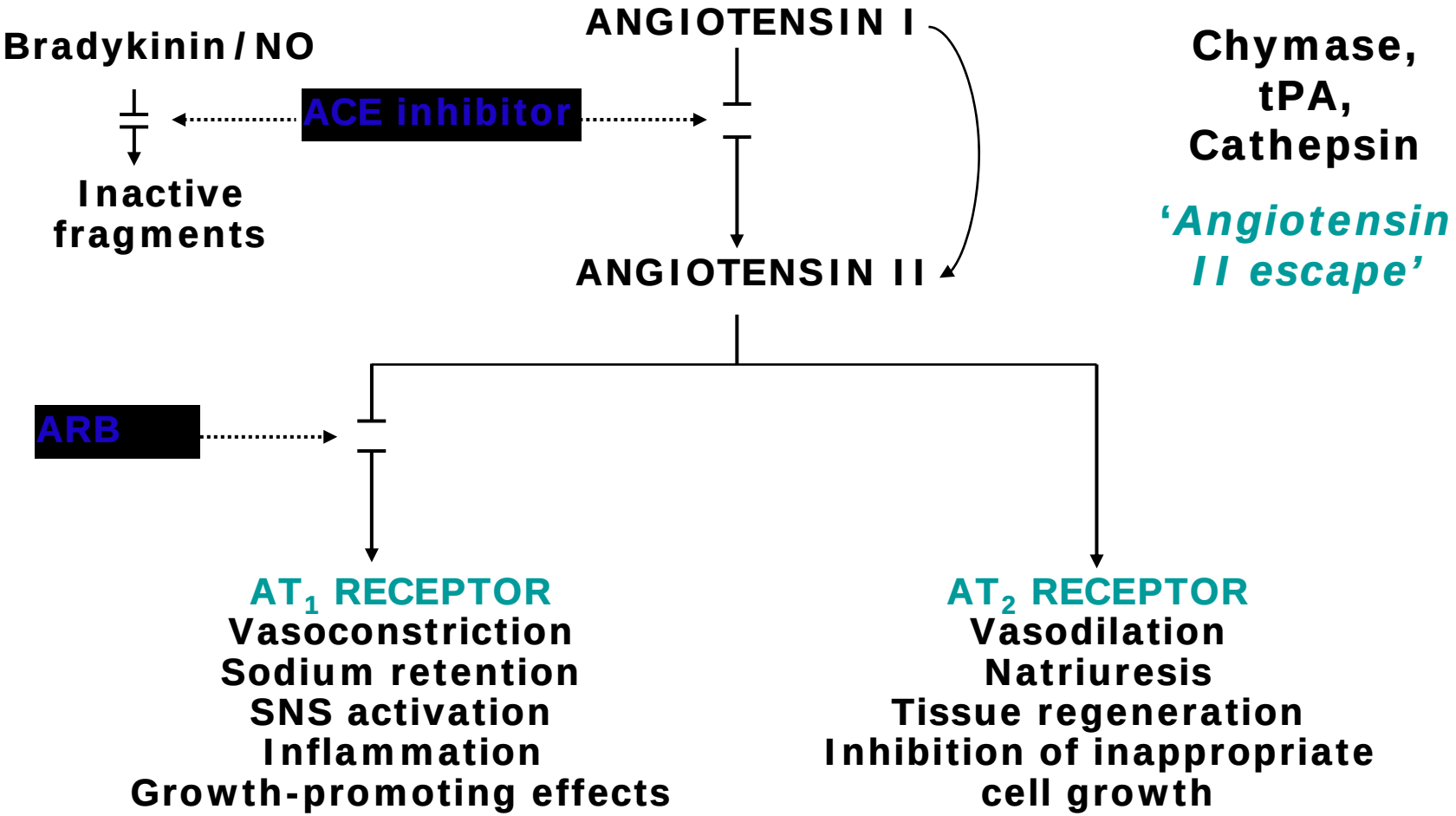
The renin-angiotensin-aldosterone system



Pathophysiologic Effects of Angiotensin II



Site of action of ACE inhibition and angiotensin type 1 receptor blockade



Hypertension and Anihypertensive Agents in Diabetic Kidney Disease

Clinical assessment	Target blood pressure	Preferred agents for CKD	Other agents to reduce CVD risk and reach target blood pressure
Blood pressure ≥ 130/80 mmHg	< 130/80 mmHg **B**	ACEI or ARB **A**	Diuretic preferred, then beta-blocker or calcium-channel blocker
Blood pressure < 130/80 mmHg		ACEI or ARB **A**	

Bold letters denote strength of recommendations

Hypertension and Anihypertensive Agents in Nondiabetic Kidney Disease

Clinical assessment	Target blood pressure	Preferred agents for CKD	Additional agents to reduce CVD risk and reach target blood pressure
Blood pressure ≥ 130/80 mmHg and spot urine total protein-to-creatinine ratio ≥ 200 mg/g	< 130/80 mmHg **A**	ACEI or ARB **A**	Diuretic preferred, then beta-blocker or calcium-channel blocker

Bold letters represent strength of recommendations

Hypertension and Anihypertensive Agents in Nondiabetic Kidney Disease (cont.)

Clinical assessment	Target blood pressure	Preferred agents for CKD	Additional agents to reduce CVD risk and reach target blood pressure
Blood pressure ≥ 130/80 mmHg and spot urine total protein-to-creatinine ratio < 200 mg/g	< 130/80 mmHg **B**	None preferred	Diuretic preferred, then ACEI, ARB, beta-blocker or calcium-channel blocker

Bold letters represent strength of recommendations

Hypertension and Anihypertensive Agents in Nondiabetic Kidney Disease (cont.)

Clinical assessment	Target blood pressure	Preferred agents for CKD	Additional agents to reduce CVD risk and reach target blood pressure
Blood pressure < 130/80 mmHg and spot urine total protein-to-creatinine ratio ≥ 200 mg/g		ACEI or ARB **C**	Diuretic preferred, then beta-blocker or calcium-channel blocker

Bold letters represent strength of recommendations

Hypertension and Anihypertensive Agents in Nondiabetic Kidney Disease (cont.)

Clinical assessment	Target blood pressure	Preferred agents for CKD	Additional agents to reduce CVD risk and reach target blood pressure
Blood pressure < 130/80 mmHg and spot urine total protein-to-creatinine ratio < 200 mg/g		None preferred	

Recommended Intervals for Monitoring Blood Pressure,GFR and Serum Potassium for Side Effects of ACEIs or ARBs in CKD

Baseline value		
SBP, mmHg	≥ 120	< 120
GFR, mL/min/1.73 m^2	≥ 60	< 60
Early GFR decline, %	< 15	≥ 15
Serum Potassium, mEq/L	≤ 4.5	> 4.5
Interval		
After initiation or increase in dose of ACEI or ARB	4-12 weeks	2 weeks
After blood pressure is at goal and dose is stable	6-12 months	2 months

Summary of Use of ACE Inhibitors and ARBs in CKD

1. Indications	• Diabetic kidney disease • Nondiabetic kidney disease with spot urine total protein-to-creatinine ratio > 200 mg/g • Consider in kidney transplant recipients with spot urine total protein-to-creatinine ratio > 500-1,000 mg/g
2. Doses Used in Controlled trials (mg/d)	• ACE inhibitors (benazepril 30, captopril 100, lisinopril 20, perindopril 4, ramipril 10, trandolopril 3) • ARBs (candesartan 16, irbesartan 300, losartan 100, valsartan 160)

Summary of Use of ACE Inhibitors and ARBs in CKD (Cont.)

3. Side-Effects	• Hypotension, early decrease in GFR, hyperkalemia, cough, angioneurotic edema, rash, contraindicated in 2nd and 3rd trimesters of pregnancy (recommend contraception to women of child-bearing age)
4. Causes of Early Decrease in GFR	• ECF volume depletion, hypotension, renal artery disease (bilateral or unilateral with a solitary kidney)

Summary of Use of ACE Inhibitors and ARBs in CKD (Cont.)

5. Causes of Hyperkalemia

- Increase potassium intake (high potassium foods, supplements, herbal supplement, transfusions, salt substitutes)
- Metabolic acidosis
- Acute GFR decline
- Drugs (beta-blockers, heparin, NSAID, Cox 2 inhibitors, heparin, digoxin overdose, potassium supplements, herbal supplements, potassium-sparing diuretics, cyclosporine, tacrolimus, pentamidine, trimethoprim, lithium.
- Laboratory error

Summary of Use of ACE Inhibitors and ARBs in CKD (Cont.)

6. Frequency of Monitoring for Side Effects (Blood Pressure, GFR, Serum Potassium)

- If SBP < 120 mm Hg, GFR < 60 mL/min/1.73 m^2, change in GFR ≥ 15%, or serum potassium > 4.5 mEq/L,
  - ≤ 4 weeks after initiation or increase in dose, or
  - 1-6 months after blood pressure is at goal and dose is stable.

Summary of Use of ACE Inhibitors and ARBs in CKD (Cont.)

7. Conditions in which ACE Inhibitors or ARBs Should Not be Used or Used with Caution

- Pregnancy
- History of cough, angioedema or other allergic reaction
- Bilateral renal artery stenosis
- Serum potassium > 5.5 mEq/L despite treatment
- GFR decline > 30% within 4 months without explanation

Circumstances in which ACEIs and ARBs Should Not Be Used

	Do not use	Use with caution
ACEI	Pregnancy (A) History of angioedema (A) Cough due to ACEIs (A) Allergy to ACEI or ARB (A)	Women not practicing contraception (A) Bilateral renal artery stenosis* (A) Drugs causing hyperkalemia (A)
ARB	Allergy to ACEI or ARB (A) Pregnancy (C) Cough due to ARB (C)	Bilateral renal artery stenosis* (A) Drugs causing hyperkalemia (A) Women not practicing contraception (C) Angioedema due to ACEI (C)

* Including renal artery stenosis in the kidney transplant or in a solitary kidney.

Letter in parenthesis denote strength of recommendation.

A comprehensive strategy and therapeutic goals for achieving maximal renoprotection in patients with chronic renal disease

Intervention	Goal
1. ACEI or ARB treatment (consider combination therapy if goals not achieved with monotherapy)	Proteinuria < 0.5 g/day GFR decline < 1 mL/min/month
2. Additional antihypertensive therapy	BP < 125/75 if proteinuria > 1 g/day BP < 130/80 if proteinuria < 1 g/day
3. Dietary protein restriction	0.6 g/kg/day
4. Tight glycemic control	HBA_{1C} < 6.5 %
5. Smoking cessation	
6. Lipid-lowering therapy	


THANK YOU
FOR YOUR
ATTENTION