9 Diuretics

What will I learn?

In this section you will learn:

- Why diuretics should be used in heart failure
- How they improve symptoms and outcomes
- How to start and titrate the dose
- What the possible side effects are and what to do about them

Activation of the RAAS by the failing heart leads to fluid and salt retention. If we are to relieve the symptoms caused by the overloaded circulation, we need to give a diuretic to remove the extra fluid from the system.

The diuresis caused by thiazide diuretics such as bendroflumethiazide is usually fairly mild, whereas loop diuretics such as furosemide are more powerful and will cause the body to swiftly excrete the excessive amounts of fluid being retained. This allows the patient to feel much better in a matter of hours. It is important to remember, then, that the action of diuretics is a positive effect, rather than an annoying side effect. If the fluid is not removed from the body it will remain, causing more symptoms and eventual death.

Another drug that has a powerful diuretic effect is metolazone. This can be very useful in intractable oedema but care should be taken with the dose. Renal function, urea and electrolytes should also be closely observed.

Which diuretics can be used?

There are three main sub-groups of diuretics:

- *loop diuretics*, which have a strong diuretic action
- *thiazide diuretics*, which work more gently and are often used in hypertension because of their effect on the vasculature of the vessels
- *potassium-sparing diuretics*, which can be useful in maintaining potassium levels in patients at risk of hypokalaemia.

Occasionally, and usually under specialist advice, a thiazide is added to a loop diuretic to improve the diuretic effect. Metolazone is unusual in that it has a strong diuretic effect despite being a thiazide diuretic. It can be useful in persistent oedema but care must be taken to monitor renal function as it can quickly lead to electrolyte imbalance.

How do diuretics improve symptoms and outcomes?

Loop diuretics will improve symptoms associated with fluid overload within hours of being taken. However, of all the drugs used in heart failure management, diuretics are the only ones that have no effect on progression of the disease or mortality. They are used purely to relieve symptoms and thus improve quality of life.

How do I start and titrate diuretics?

As they are used for symptomatic relief only, the dose should be set at that which improves symptoms such as ankle oedema and breathlessness. When the patient needs more, he takes more; as symptoms improve, he takes less and he may even be able to stop diuretic therapy for periods of time (Table 1).

Table 1. Diuretic therapy – ESC guidelines

Initial diuretic treatment
Loop diuretics or thiazides. Always administered in addition to an ACE inhibitor If GFR < 30ml/min do not use thiazides, except as therapy prescribed synergistically with loop diuretics *Insufficient response:* Increase dose of diuretic Combine loop diuretic and thiazide With persistant fluid retention: administer loop diuretic twice daily In severe heart failure add: metolazone with frequent measurement of creatinine and electrolytes ***Potassium-sparing diuretics:*** triamterene, amiloride, spironolactone Use only if hypokalaemia persists after initiation of therapy with ACE inhibitors and diuretics Start one-week low-dose administration; check serum potassium and creatinine levels after 5–7 days and titrate accordingly. Recheck every 5–7 days until potassium values are stable
GFR = glomerular filtration rate.

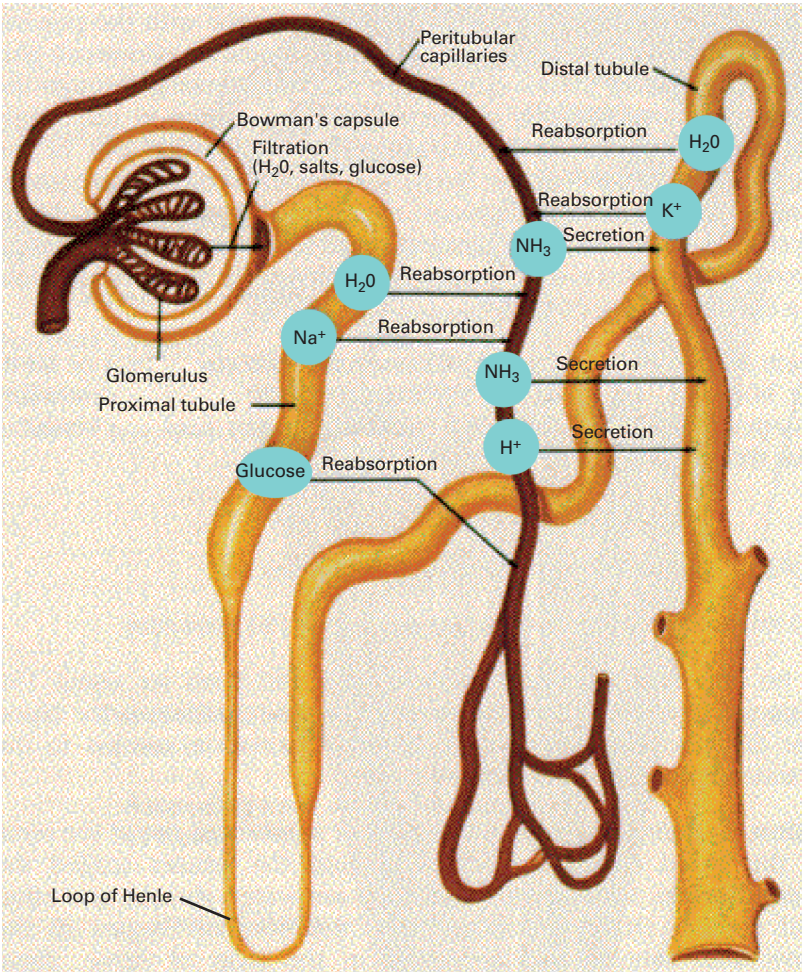
Side effects

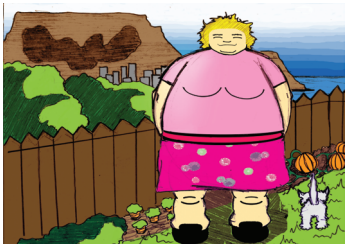
Loop diuretics act on the Loop of Henle in the kidney and prevent reabsorption of water and salt. A potential side effect of this activity is that they may cause electrolyte imbalances. Other side effects include gout, which results from raised uric acid levels (hyperuricaemia) (Table 2, Fig. 1).

Table 2. Diuretics (oral): dosages and side effects

Diuretics	Initial dose (mg)		Maximum recommended daily dose (mg)		Major side effects
Loop diuretics					
Furosemide	20–40		250–500		Hypokalaemia, hypomagnesaemia, hyponatraemia
Bumetanide	0.5–1.0		5–10		Hyperuricaemia, glucose intolerance
Torasemide	5–10		100–200		Acid–base disturbance
Thiazides					
Bendroflumethiazide	2.5		10		Hypokalaemia, hypomagnesaemia, hyponatraemia
Hydrochlorothiazide	25		50–75		Hypokalaemia, hypomagnesaemia, hyponatraemia
Metolazone	2.5		10		Hyperuricaemia, glucose intolerance
Indapamide	2.5		5		Acid–base disturbance
Potassium-sparing diuretics	+ACEI	–ACEI	+ACEI	–ACEI	
Amiloride	2.5	5	20	40	Hyperkalaemia, rash
Triamterene	25	50	100	200	Hyperkalaemia
Spironolactone	12.5–25	50	50	100–200	Hyperkalaemia, gynaecomastia, breast pain

Figure 1. Sites of reabsorption and secretion in the nephron of the kidney.





Rosie presented with swollen feet. Consider how the use of loop diuretic therapy might help her symptoms. A dose of 40–80 mg is often used initially. What dose would you use and when would you alter the dose?

For a revision session on the anatomy and physiology of the kidneys and renal system try www.siumed.edu/~dking2/crr/rnguide.htm. Although this is a histology website, it gives a thorough overview with useful illustrations.

For more information on the pharmacological aspects of diuretics go to http://umed.med.utah.edu/ms2/renal/Word%20files/f)%20Diuretics.htm

What you need to know

- ☐ Diuretics should be used in heart failure for symptomatic control.
- ☐ Loop diuretics work by restricting fluid and salt retention in the loop of Henle; this results in the loss of fluid and salt from the overloaded system, which in turn relieves symptoms such as oedema and dyspnoea.
- ☐ The dose should be started at a level appropriate to the severity of symptoms and should be decreased as the symptoms improve – this will ensure that symptoms are treated effectively.
- ☐ Possible side effects include urea and electrolyte disturbances and dehydration. These can be reduced by titrating the dose to the appropriate level to avoid over-treatment.

Self-assessment questions

Take a minute to test your knowledge:

1. What are the main sub-groups of diuretics?
2. How would you explain to a patient the benefits of starting treatment with furosemide?
3. Which side effects would you monitor for and how would you do this?