

## Aminoglycosides and Ototoxicity

### Important Points

Aminoglycosides (e.g. gentamicin) are used to treat serious and life threatening bacterial infections.

Prompt administration of the first dose is essential to avoid increased sepsis mortality (follow [SEPSIS SIX](#))

Courses >7 days are more likely to be associated with ototoxicity.

The risk of developing ototoxicity can be irrespective of dose and blood concentration measurements.

Prescriptions should be reviewed daily and duration limited to a maximum of 3 or 4 days unless specified by Microbiology/Infectious Diseases (ID) specialist.

After commencement of gentamicin, pre-dose toxicity checks should be carried out for all patients prior to subsequent doses.

### What is ototoxicity?

“Ototoxicity” is defined as damage to ear function. It is a rare, potentially serious and irreversible adverse effect that can occur with **all** aminoglycosides. Ototoxicity affects both hearing (cochlear) and balance (vestibular) functions of the ear. Table 1 describes the symptoms.

Vestibular toxicity	Cochlear toxicity
Imbalance, dizziness, oscillopsia, vertigo, persistent nausea & vomiting, nystagmus, ataxia, tinnitus	Bilateral sensorineural hearing loss beginning at high frequencies, tinnitus

Table 1 Symptoms of aminoglycoside-induced ototoxicity

### What is the risk of developing it?

Although courses lasting more than one week are more likely to be associated with ototoxicity, it can occur with shorter courses and therefore care should be taken in all patients.

Ototoxicity can occur irrespective of aminoglycoside dose, blood concentration measurements or renal function. However, persistently high aminoglycoside concentrations are considered a risk factor. Other suggested risk factors include, genetic predisposition, concomitant prescription of other ototoxic agents e.g.

furosemide, multiple repeated courses of aminoglycosides and age > 65years.

Patients with underlying hearing impairment/disorder that is unrelated to aminoglycoside therapy should still receive aminoglycosides where indicated.

In NHS GGC, gentamicin is the most commonly used aminoglycoside. In some circumstances, necessary prolonged use has been associated with ototoxicity. A retrospective review of over 1000 NHS GGC patients who had received gentamicin estimated the incidence of ototoxicity to be < 2 %, however, this could be an underestimate of the actual problem.

### How can the risk be reduced?

In addition to using the new [gentamicin prescribing chart](#), the guidance below should be followed to reduce the risk of ototoxicity:

- After commencement of gentamicin, carry out pre-dose toxicity checks (see table 1) for all patients prior to subsequent doses.

**Please note:** Ask the patient if they are experiencing any symptoms of vestibular toxicity or hearing loss. If signs are reported, see section below titled ‘How should ototoxicity be managed?’.

- Calculate the initial gentamicin dose using the [gentamicin calculator](#) on StaffNet.
- Monitor and interpret gentamicin levels as per NHS GGC guidance. Seek advice from pharmacy if unsure.
- Consult Microbiology/ ID if > 3 – 4 days of treatment is anticipated to discuss future therapy.
- Request an audiogram if aminoglycoside therapy is anticipated to continue for >7 days. Repeat audiogram every 2 weeks whilst receiving therapy.

### How should ototoxicity be managed?

Prompt recognition of the symptoms and withholding the aminoglycoside is essential for patient safety. Contact Microbiology/ID immediately for advice on future therapy. In addition the patient should also be discussed with ENT.

### What about nephrotoxicity?

Full discussion of aminoglycoside-induced nephrotoxicity is out-with the scope of this article. However, it is important to stress that as aminoglycosides can also cause nephrotoxicity, renal function must be monitored daily during therapy and assessed prior to prescribing each dose.

## Pyridostigmine for Myasthenia Gravis

A number of incidents with the medicine pyridostigmine (for Myasthenia Gravis) have occurred in hospitals, highlighting the need to raise awareness of these risks. A number of 'missed dose' incidents have resulted in significant consequences for the patient and therefore it is essential that staff are aware of the urgency of obtaining and administering this medicine, particularly if it is not normally stocked on the ward.

The key risks are summarised below:

- Pyridostigmine should never be delayed or omitted.
- Obtain supply via pharmacy, ward 67 at SGH or the Emergency Duty Pharmacist
- Any delays or omission of the drug (even for a short period of time) may result in exacerbation of myasthenic symptoms such as muscle weakness and swallowing difficulties, with associated risks such as respiratory failure. Delays may even trigger a myasthenic crisis, which can be fatal.
- Crush and administer via a nasogastric (NG) tube if the patient is unable to swallow.
- If the oral/NG route is not available then seek specialist neurology advice on using parenteral neostigmine as an alternative.
- Check the dose before administering the medicine. Be aware that dose requirements may vary and that patients may require slightly higher doses if experiencing a myasthenic relapse or suffering from infection or stress – seek urgent Neurology advice.
- Symptoms of over and under-dosing may be similar and can be life-threatening (cholinergic crisis or myasthenic crisis respectively).
- There are a number of medicines e.g gentamicin which may exacerbate myasthenia gravis and should be avoided unless clinically necessary.

A pyridostigmine Q&A will soon be available on Staffnet to address the issues above and will contain information on the following:

- how to manage the patient if a dose has already been missed
- a list of medicines known to exacerbate Myasthenia Gravis.
- differentiation between cholinergic crisis and myasthenic crisis
- side-effects of pyridostigmine
- use of parenteral cholinesterase inhibitors e.g. neostigmine
- pyridostigmine administration via an NG tube

For further information contact Lesley Murray ([lesley.murray@ggc.scot.nhs.uk](mailto:lesley.murray@ggc.scot.nhs.uk))

## Chance to Check and Wrong Patient Incidents

'Wrong patient' incidents occur, where one patient is incorrectly given or takes another patient's medicines. There are various scenarios where this can occur:

1. The prescription has been written for the wrong patient
2. The healthcare professional gives the correct prescription to the wrong patient
3. The medicine is left unattended and taken by the wrong patient.

Since 2010, the '[Chance to Check](#)' initiative has been introduced to reduce these incidents by promoting a mental checklist that nursing staff ask themselves when administering medicines.

1. Chance to Check has the potential to reduce the first scenario because nurses are asking themselves if the drug and dose is suitable for the person they are giving it to. The following types of incidents could be prevented:-
  - administration of metformin to a non diabetic patient or,
  - a patient being administered their relatives beta blocker because it was included in the box of medicines brought in from home when they were admitted.
2. Risk of the second scenario occurring is reduced because part of the process insists the name band is checked with the medicines kardex, regardless of how well they know the patient. Errors related to the member of staff administering from the wrong kardex should be reduced by checking the name band.
3. The last scenario is reduced by the post round sweep which states that the medication round is not complete until all cups are gathered in and the nurse can confirm that any medication, which may have been left with a patient, has been taken. This can be done in bays or at the end of the medication round.

Some 'wrong patient' incidents are difficult to detect. If the doctor writes the wrong drugs on a Kardex but they appear to be reasonable medicines and doses for the patient they are written for, the nurse is less likely to detect the problem. This risk can however be minimised by discussing the *name* of the medicine with the patient as it is being administered.

The initiative has been received well and continues to be rolled out across the Board. For more information on Chance to Check contact Karon Cormack or check out the [web page](#).