UK NPIS 0344 892 0111
Ireland NPIC (01) 809 2566

Atropa belladonna

(Belladonna)

Updated 2/2025

Common Names

Banewort, Belladonna, Deadly nightshade, Dwale

Description

Perennial plant or shrub native to Europe, North Africa, Western Asia and some parts of the USA and Canada. In the UK it is found mainly in central and southern England. Grows up to 1.5 m tall. Flowers are greenish-purple, leaves are approximately 20 cm long. Black berries the size of cherries ripening in August to October.

Toxins

Tropane alkaloids: atropine (aka DL-hyoscyamine), hyoscyamine (aka L-atropine), and scopolamine (aka hyoscine) found in all parts of the plant.

Toxicity

Toxicity is mainly due to anticholinergic effects at autonomic nerve endings and in the brain.

In a case series of 49 children suffering anticholinergic toxicity following ingestion of *Atropa belladonna*, the most common features were tachycardia, flushing, mydriasis, dry mouth, agitation and hyperglycaemia. Six children suffered encephalopathy and were classified as suffering severe intoxication; in these patients the most common features were confusion, mydriasis, lethargy and coma (Caksen et al, 2003).

Anticholinergic toxicity has been reported after use of 'homeopathic' medicines containing *Atropa belladonna*. A 23-day old boy was admitted to intensive care with anticholinergic syndrome with supraventricular tachycardia after being administered homeopathic medicine containing belladonna to treat infantile colic (Rodriguez-Gonzalez et al, 2014).

A 27-year-old man and a 28-year-old pregnant woman presented with severe anticholinergic syndrome and required intensive care after using a marshmallow root (*Althaea officinalis*) herbal remedy to treat the common cold. The herbs were found to be contaminated with atropine, most probably derived from deadly nightshade (*Atropa belladonna*) (Oerlemans et al, 2017).

A 50-year-old herbalist used a preparation containing *Atropa belladonna* to treat insomnia and required mechanical ventilation to treat anticholinergic syndrome (Chadwick et al, 2015).

A 53-year-old man presented with anticholinergic signs and symptoms including confusion, anxiety, ataxia, dry mouth, blurred vision, dysarthria, muscle weakness, and urinary retention following ingesting 30 drops of a 'homeopathic'; solution containing *Atropa belladonna*. His symptoms gradually subsided without the need for medical intervention. The patient reported residual urinary retention lasting for one day and fatigue for three days following the incident. Atropine was detected in both the homeopathic solution and the patient's blood (Schmoll et al, 2022).

A 55-year-old woman developed acute angle-closure glaucoma after using 'homeopathic' eyedrops containing *Atropa belladonna*. Referral to ophthalmology and discontinuation of the eyedrops led to a full recovery without lasting effects (Huff et al, 2021).

There may be a direct pupillary effect (dilated pupils) in patients who touch their eyes following skin contact with (e.g. handling of) plants and plant materials. Mydriasis may only occur in one pupil, depending on the pattern of contact.

! Toxic Substance

All patients who have been exposed to this product as a result of self-harm should be referred for assessment.

All children should be referred for medical assessment.

Adults who are symptomatic should be referred for medical assessment.

Consider discussion with NPIS: In the UK NPIS **0344 892 0111** / in Ireland NPIC **(01) 809 2566**.

Adults who have accidentally ingested *Atropa belladonna* and have no new symptoms since the time of ingestion do not need to be referred for medical assessment. Patients should be advised to seek medical attention if symptoms develop.

Anticholinergic plants - features and management

Updated 2/2025

✚ Alert for hospital doctors

This agent is potentially very toxic and clinicians managing patients are encouraged to discuss **serious** cases with your poisons information service: in the UK NPIS **0344 892 0111**, in Ireland NPIC (01) 809 2566.

Click here for details you may be required to give when telephoning NPIS.

Features

Anticholinergics block the neurotransmitter acetylcholine at muscarinic receptors causing toxicity in the peripheral and/or the central nervous systems.

Peripheral anticholinergic effects include: flushing, dilated pupils, blurred vision, dry mouth and tongue, hot dry skin, fever, decreased gastric motility and urinary retention. There may also be transient bradycardia followed by sinus tachycardia, hypertension, nausea, vomiting and tachypnoea.

Central anticholinergic effects include: ataxia, delirium, agitation, aggression, visual and auditory hallucinations (which may persist for several days following severe poisonings), speech disorders, convulsions, myoclonus, hypertonia, hyperpyrexia, muscle weakness, dizziness, and confusion. In severe cases CNS excitation may give way to CNS depression, circulatory and respiratory failure and coma.

Other features may include: cardiac conduction abnormalities and arrhythmias, paralytic ileus, hyperglycaemia, rash and glaucoma. Abnormal liver and renal function and rhabdomyolysis have also been reported. Patients who have been unconscious may be hypothermic.

Skin contact
Skin contact may cause dermatitis and blistering. Systemic features may arise.

Eye contact
Marked dilation of the pupils and systemic features may arise. Following direct eye contact, mydriasis may only occur in one eye. Acute angle-closure glaucoma may also occur following eye exposure to atropine-containing substances.

Management

Ingestion

1. Maintain a clear airway and ensure adequate ventilation.
2. **Cardiac arrest**
   In the event of cardiac arrest in hospital or witnessed out of hospital cardiac arrest with prompt bystander CPR, resuscitation should be usually continued for at least 1 hour and only stopped after discussion with a senior clinician.

   If the patient may have been exposed to a sodium channel antagonist, or if QRS duration had been prolonged prior to cardiac arrest, administer a rapid bolus of 100 mL of 8.4% sodium bicarbonate urgently, preferably into a large vein. 8.4% sodium bicarbonate is irritant and should be preceded and followed by a large fluid flush to confirm cannula position and reduce local contact. Monitor pH and administer further doses as necessary. Click here for further advice on managing ECG abnormalities.

   Prolonged resuscitation, even for several hours, may be appropriate following poisoning as recovery with good neurological outcome may occur.
3. **The benefit of gastric decontamination using activated charcoal is uncertain.** Consider activated charcoal (charcoal dose: 50 g for adults; 1 g/kg for children) if the patient presents within 1 hour of ingestion of any amount, providing it is safe to do so and the airway can be protected. Efficacy declines rapidly with time since ingestion but there may be some potential benefit from later use, especially following ingestion of highly toxic substances.

4. Monitor vital signs and cardiac rhythm; check the capillary blood glucose.

   Check and record pupil size and assess for ankle clonus.

5. Perform a 12-lead ECG in all patients who require assessment.

   Consider repeating the ECG in **ANY OF** the following circumstances:

   - The initial ECG is abnormal
   - The patient is symptomatic
   - The recommended observation period (see below) is not yet complete

   Check cardiac rhythm, QT interval and QRS duration. Click here for further advice.

6. All patients should be observed for at least 6 hours after ingestion.

   At the end of this period patients who have a normal heart rate and normal repeat 12-lead-ECG and who are then alert and asymptomatic, can be considered for discharge with advice to return if symptoms develop. Symptomatic patients should be observed until symptoms are resolved.

7. In symptomatic patients check FBC, U&Es, LFTs, CK and blood glucose.

8. Assess for urinary retention. Patients may require catheterisation.

9. Consider arterial/venous blood gas analysis in patients who have a reduced level of consciousness, reduced oxygen saturation on pulse oximetry or metabolic disturbance.

10. **Agitation and delirium/psychosis**
    Where available, follow local guidelines for treatment of agitation and delirium.

    The primary goal of management is to keep patient and staff safe while allowing continued evaluation. Ensure other causes are excluded (e.g. hypoxia, infection, hypoglycaemia and raised ICP). Attempt de-escalation by reducing environmental stimuli (e.g. quiet room) and providing basic needs (e.g. a close relative, a warm blanket and food (if appropriate)).

    For pharmacotherapy in adults:
    Give an initial dose of oral or IV diazepam (10-20 mg) or lorazepam (1-2 mg). Further boluses, given IV, may be administered if the patient remains agitated, provided there is no impairment of respiratory function.

    If oral and IV routes are not available give lorazepam IM (1-2 mg) or midazolam IM (5-10 mg) repeated as necessary.

    Patients with severe agitation may need high doses of intravenous diazepam (total dose in excess of 100 mg given incrementally). These patients need urgent referral to critical care.

    Haloperidol (5-10 mg IM) may be an adjunct when agitation remains resistant to two or more benzodiazepine doses as described above. Antipsychotics should be avoided in patients with Parkinson's disease or Lewy body dementia.

    Ketamine has also been used for uncontrolled agitation but must be used by a practitioner experienced in its use in an appropriate clinical environment with equipment for intubation if necessary.

    Click here for pharmacotherapy in children

11. **Hyperthermia**
    Mild to moderate hyperthermia may respond to conventional cooling measures such as:

    - Mist and fan techniques
    - Ice packs to groin and axillae
    - External cooling devices.

When rising body temperature exceeds 38.5°C, urgent cooling measures with regular monitoring of core temperature, at least every 30 minutes, should be employed according to local protocols. Such measures include:

● Ice-baths (may achieve rapid cooling but caution in elderly/comorbidities)

● Internal/invasive measures - cold fluid lavage (gastric, bladder, peritoneal), intravascular cooling techniques.

Sedation should be employed where it can be safely performed (diazepam 10-20 mg in adults; 0.25 mg/kg body weight in children).

Patients with severe hyperthermia may need high doses of intravenous diazepam (total dose in excess of 100 mg given incrementally). These patients need urgent referral to critical care.

Severe hyperthermia carries a high mortality rate, urgent intervention is recommended.

Rapid sequence intubation with paralysis is usually warranted when the temperature is rising rapidly and is not controlled by the above measures.

If hyperkalaemia is likely, avoid suxamethonium.

On-going neuromuscular paralysis, and sedation with a benzodiazepine infusion, is recommended in addition to cooling measures (see above) as per local protocols.

Dantrolene may be considered where there is muscular hyperactivity (initially 2-3 mg/kg by intravenous injection, to a maximum of 10 mg/kg. For further information click here).

In patients with pyrexia, monitor renal function and CK activity. Ensure adequate hydration and monitor urine output carefully.

Consider other causes as hyperthermia may be caused by conditions other than poisoning.

If serotonin toxicity is present click here for management.

If neuroleptic malignant syndrome is present click here for management.

If hyperthermia persists despite the above measures discuss with your local poisons information service: in the UK NPIS **0344 892 0111**, in Ireland NPIC (01) 809 2566.

Click here for details you may be required to give when telephoning NPIS.

12. **Hypotension**
Ensure adequate fluid resuscitation.

Consider early referral to critical care for patients with fluid-resistant hypotension, as these patients can deteriorate extremely rapidly; the management of children with fluid-resistant hypotension should be overseen by an experienced paediatrician.

Invasive vascular monitoring and echocardiography may help determine the likely relative benefits of inotropes and vasopressors because reduced cardiac output and vasodilation often co-exist in severe or mixed poisoning.

There have been very occasional reports of worsening of hypotension associated with adrenaline treatment, thought to be due to beta-receptor agonist effects.

Vasopressors and inotropes can be initiated in an emergency through peripheral venous access but only under the direction of an experienced physician. Click here for further advice on doses.

Contact the NPIS for further advice about patients who remain in refractory shock despite the above treatments; in the UK NPIS **0344 892 0111**, in Ireland NPIC (01) 809 2566.

13. **Convulsions**
    Give oxygen, check blood glucose, U&Es, calcium, magnesium, phosphate and blood gases. Correct acid base and metabolic disturbances as required.

    Single brief convulsions do not require treatment.

    Control convulsions that are frequent or prolonged with intravenous diazepam (10-20 mg in adults; 0.1-0.3 mg/kg body weight in children), lorazepam (4 mg in adults; 0.1 mg/kg in children), or midazolam (5-10 mg in adults; 0.05-0.15 mg/kg in children).

    Further doses of benzodiazepines may be needed in adults; refer to intensive care. In children seek consultant paediatric input.

    If unresponsive to the above measures, the patient should be referred urgently to critical care. The NPIS recommends barbiturates as second line therapy and avoidance of phenytoin.

    Click here for further management

    Discuss severe cases with your local poisons information service: in the UK NPIS **0344 892 0111**, in Ireland NPIC (01) 809 2566.

    Click here for details you may be required to give when telephoning NPIS.

14. **Metabolic acidosis**
    If metabolic acidosis persists despite correction of hypoxia and adequate fluid resuscitation consider correction with intravenous sodium bicarbonate. Ensure serum potassium is within normal range as administration of sodium bicarbonate may worsen hypokalaemia.

    Adults: an initial dose of 50-100 mmol sodium bicarbonate (e.g. 50-100 mL 8.4% or 100-200 mL 4.2%) may be given and repeated as necessary, guided by arterial blood gas monitoring, aiming for a normal pH. The volumes for different concentrations of sodium bicarbonate to achieve a dose of 50-100 mmol in adults are shown here.

    Children: Give 1-2 mmol/kg sodium bicarbonate (1-2 mL/kg 8.4% or 2-4 mL/kg 4.2%) over 20 minutes. Repeat as necessary, aiming for a normal pH.

    Since 4.2% and 8.4% bicarbonate are irritant to veins, and can rarely cause local necrosis in cases of extravasation, administer into a large vein (or via a central line where possible). A bolus should be preceded and followed by a large flush to confirm cannula position and to reduce local contact.

    Adults and children: Recheck acid base status after administration of sodium bicarbonate. For severe acidosis, large amounts of bicarbonate with repeated pH checking may be required to correct the metabolic acidosis.

    Click here for further information on metabolic acidosis

15. **Rhabdomyolysis**
    If rhabdomyolysis is present (CK activity greater than 5 x the upper limit of the normal range), renal failure can develop, particularly if the CK activity is greater than 5000 iu/L.

    Give intravenous volume replacement as soon as possible and continue in order to maintain an adequate urine output (≥1mL/kg/h).

    Monitor closely for development of metabolic acidosis and manage appropriately.

    Monitor fluid balance, plasma sodium and potassium and urine pH. Beware severe hyperkalaemia.

    There are theoretical reasons why urine alkalinisation may be helpful in preventing or reducing the severity of rhabdomyolysis-induced renal failure. Despite insufficient data to confirm this role in the poisoned patient, it may be considered in addition to intravenous fluid therapy which remains the mainstay of treatment.

Adults:
Give 225 mmol sodium bicarbonate i.e.:
1.5 L of 1.26% over two hours
Or
225 mL of 8.4% over one hour
Click here for volumes needed for other concentrations.

Aim to increase the urine pH to greater than 7.5.

Children:
Give 4-10 mL/kg of 4.2% sodium bicarbonate diluted in an equal volume of 5% glucose over one hour.

In both adults and children:
Further doses of sodium bicarbonate may be required to obtain and subsequently maintain a urine pH greater than 7.5.

Since 4.2% and 8.4% bicarbonate are irritant to veins, and can rarely cause local necrosis in cases of extravasation, administer into a large vein (or via a central line where possible). A bolus should be preceded and followed by a large flush to confirm cannula position and to reduce local contact.

The urinary pH should be checked hourly. Plasma sodium and potassium should also be checked 1-2 hourly, and potassium replaced IV, if necessary, to maintain plasma potassium around 4-4.5 mmol/L.

Haemodiafiltration can effectively remove myoglobin from the circulation; haemodiafiltration combined with urine alkalinization is more effective than urine alkalinization alone (Peltonen et al, 2007).

Haemodialysis / haemodiafiltration / haemofiltration may be required if acute renal failure develops or severe hyperkalaemia is present.

If initial CK is normal but there is concern about muscle damage consider repeat measurement.

16. Other measures as indicated by the patient's clinical condition.

    Patients should be advised on discharge to seek medical attention if symptoms subsequently develop.

Skin Contact

1. Decontaminate the patient.
2. Treat skin blisters as burns.
3. If systemic features arise manage as per ingestion.
4. Other measures as indicated by the patient's clinical condition.

   Patients should be advised on discharge to seek medical attention if symptoms subsequently develop.

Eye Contact

1. Immediately irrigate the affected eye thoroughly. For further advice, click here.
2. If systemic features arise manage as per ingestion.
3. Other measures as indicated by the patient's clinical condition.

Patients should be advised on discharge to seek medical attention if symptoms subsequently develop.

Additional Information

Activated charcoal

Anticholinergic plant references

UK NPIS 0344 892 0111 / NPIC (Ireland) 01 809 2566 / mail@toxbase.org