Plant ingestion: foxglove toxinology

Scott Phillips

On our planet, there are over 1 million scientifically-named plants (only a third of which are assigned species names). And there are 7.5 billion potential consumers of these plants! Throughout the world, poisoning information centers report plant ingestion as a common exposure. In 2015, The American Association of Poison Control Centers (AAPCC) reported over 45,000 plant exposures. Counted among the top ten are cardiac glycosides (digitalis, convallarin, ouabain, oleandrin, bufadienolide, and more). Cardiac glycoside plants contain multiple and diverse glycosides.

As early as the 16th century, scientists suspected Foxglove's beneficial medical effects, although it wasn't until January 1785 that Erasmus Darwin (Charles Darwin's grandfather) submitted to the College of Physicians in London An Account of the Successful Use of Foxglove in Some Dropsies and in Pulmonary Consumption, and later that same year, Willian Withering published the classic text An Account of the Foxglove and some of its Medical Uses.

According to anecdote, Withering substantiated his theory about the medical benefits of Foxglove after procuring a tea recipe from Mother Hutton, an herbalist physician from Shropshire, England, whose name and image pharmaceutical manufacturer Parke-Davis used nearly 150 years later in a marketing campaign.

Figure 1. Typical North American habitat of Foxglove

Regardless of the wellspring, Withering's description of treating a patient with dropsy whose weak irregular pulse became regular and more forceful after receiving Foxglove started scientists down the path of using digitalis for the treatment of dropsy, kidney disease and other cardiac ailments. Despite use as a remedy for over 200 years, most recently digitalis preparations have fallen out of favor clinically because, even with adequate digitalization, heart rates did not differ between treated and untreated patients. (Falk 1991)

Compared to pharmaceutical preparations, Foxglove is slowly absorbed, with a long half-life. Digitoxin, a common Foxglove glycoside, has a human half-life of 168 hours.

Novice herbalists often make Foxglove tea for diuretic use or to strengthen the heart. This may lead to a therapeutic misadventure and, within hours of ingestion, toxicity begins – with vomiting, cardiac arrhythmias and hyperkalemia. Digitalis increases intracellular sodium promoting sodium-calcium exchange leading to a rise in the intracellular calcium concentration and improved contractile performance and overall left ventricular systolic function (Smith 1988, McMahon 1996) Digitalis also exerts anti-adrenergic action by inhibiting sympathetic outflow and augmenting parasympathetic tone. As Foxglove poisoning may be deadly, consultation with a medical toxicologist is recommended.

Both digitalis plant and digitalis medication toxicity are similarly managed with digoxin fractionated antibody and supportive care. For some digitalis plant ingestions resulting in potentially life threatening toxicity, digoxin antibody may be required.

Figure 2. Flowering Foxglove

Figure 3. Foxglove leaf

For more information on common toxic plant ingestions please check our new Best Practice topic.

References

Falk RH, Leavitt JI. Digoxin for Atrial fibrillation: A drug Whose Time Has Gone? Ann Intern Med. 1991;114(7):573-575.

McMahon WS, Holzgrefe HH, Walker JD, et al. Cellular basis for improved left ventricular pump function after digoxin therapy in experimental left ventricular failure. J Am Coll Cardiol 1996; 28:495.