ACUTE CARDIAC GLYCOSIDE INTOXICATION

Clinical signs

Four organ systems are mainly affected.

Gastro-intestinal tract

In general ruminants poisoned with “tulp” presents with ruminal atony, stasis and bloat. With the exception of the red “tulp” (that causes constipation) there is often diarrhoea that may even be haemorrhagic during the later stages in the course of the disease. In livestock that has ingested “slangkop” the diarrhoea may only be transient or even absent.

Cardiovascular system

The cardiac glycosides have a negative chronotropic effect and initially a bradycardia (also attributed to the hyperkalaemia) and bradyarrhythmias may be discernable, however, the heart rate soon accelerates and tachyarrhythmias are audible on auscultation. On electrocardiography (ECG) ventricular ectopy, ventricular tachycardia, flutter and fibrillation are recorded.

The negative dromotropic effect attributed to these compounds induces 1st, 2nd and 3rd degree atrio-ventricular blocks and atrio-ventricular dissociation. These are explained as both a direct effect due to changes in the transmembrane potential and an indirect (vagotonic) effect.

Neuromuscular system

When the animals are mustered the affected animals are lagging behind the rest of the herd or flock. More severely affected animals may even be disinclined to move. Cattle that are still ambulatory exhibit typical posterior paresis (weakness of the hind quarters) (Fig. 13), which invariably progress to paralysis and the animal lies in ventral recumbency. Whole body tremors are also present.
Occasionally some animals may be restless, appear nervous, hypersensitive and incoordinated. Torticollis is often reported in stock that have been poisoned with “plakkies” (“kripsiekte” – see below) and “slingkop”.

![Fig. 13: A young heifer exhibiting weakness of the hind quarters (posterior paresis) typical for yellow “tulp” poisoning.](image)

**Respiratory system**

Initially an expiratory grunt can be audible and later dyspnoea or even periods of apnoea will indicate severe pulmonary dysfunction.

**Macroscopic and histopathology**

At necropsy no specific gross lesions are noticed and the post mortem may be regarded as rather negative. Non-specific changes such as generalized congestion, subepi- and endocardial and subcutaneous haemorrhages, lung oedema and emphysema, ruminal atony and hyperaemia of the intestinal mucosa are reported. If the animal has died peracutely leaf remnants may still be present in the rumen. “Tulp” leaves (tough, fibrous and strongly ribbed leaf) as well as oleander (hard leathery leaves) may be discerned in the rumen contents.

On microscopical examination myocardial degeneration or even necrosis and pulmonary oedema are present. In more chronic cases foci of myocardial fibrosis are seen.
Cardiac glycoside intoxication

**Diagnosis**

There are various criteria that are important to reach a diagnosis. A history of young naive animals or livestock newly introduced to the area should raise suspicion. The clinical signs, necropsy findings and histopathology report could all aid in a diagnosis. Check for the presence of the plants in the camps and whether it has been eaten.

**Treatment**

Activated charcoal at a dose of 2 g/kg live weight is very effective. A large dose is essential to effectively adsorb and bind the excess plant toxins in the rumen. Furthermore, retro-diffusion (movement of absorbed toxins back from the circulation into the gastro-intestinal tract) has been described. An “universal antidote” should not be used as it might contain too much tannic acid which will de-activate the charcoal.

Nevertheless, farmers should be warned that the excessive stress of restraining and dosing the clinically affected animal might induce fatal cardiac disturbances. After dosing minimize stress to prevent catecholamine release and keep the animals calm and rested in a kraal or small paddock.

Additional treatment for valuable animals could include anti-arrhythmic drugs such as lignocaine and β-blockers and atropine to antagonize the vagal effects, however, more research studies are required. Certain therapeutic approaches are in fact contra-indicated. Do not administer calcium solutions, adrenalin or potassium (unless hypokalaemic).

**Prevention**

Poisoning is usually controlled by fencing off infested areas. Eradication of plants by using herbicides e.g. glyphosate (“Round-up”) for “tulp” or the manual removal by digging up “slangkop” can be attempted.

**Conditioned feed aversion**

Stock that grows up on “tulp”-infested veld can learn to avoid the plant and develops a form of cognitive aversion. When sub-lethal amounts of yellow “tulp” are ingested aversion is induced. This aversion is strong, therefore poisoning usually occurs only in animals newly introduced from non-infested areas or young, naive stock. Research demonstrated that cattle could be artificially averted to yellow “tulp”. The application of this technique was confirmed in cattle grazing yellow “tulp”-infested pastures and *M. pallida*-infested harvested maize lands.

Aversion was induced by dosing an aversive mixture consisting of epoxyscillirosidin (the toxin and natural aversive substance of *M. pallida*), a lithium salt (which served as the
complementary aversive substance) and a “tulp” hexane extract (which served as identification factor for the “tulp”).

**Vaccination**

A practical way to control “tulp” poisoning could be by immunization of animals. A “tulp” vaccine will most probably protect livestock from “tulp” poisoning. If a prophylactic vaccine (consisting of the plant toxin [epoxyscilliroside] conjugated to a protein plus an adjuvant) can be produced the incidence of and mortalities caused by “Tulp” poisoning in livestock could be curtailed.

**Differential diagnoses**

There are various other intoxications that induce peracute to acute mortalities that should be ruled out. Other cardiac poisonings such as ionophore antibiotics, “gousiekte”, “gifblaar”, as well as urea, prussic acid and nitrate/nitrite poisonings are examples. Infectious causes such as black quarter, anthrax and heartwater should also be considered.