UK-VET Livestock

A guide to liver fluke in cattle — sustainable control in a changing landscape

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The liver fluke, *Fasciola hepatica* (*Figure 1*), is a prevalent and pathogenic flatworm parasite, which can cause significant production losses in grazing livestock. It has a complicated lifecycle, involving a tiny mud snail intermediate host, typically *Galba truncatula* in the UK (*Figure* 2). Liver fluke can be long-lived in sheep and cattle if not successfully treated, but it also spends considerable time outside its definitive host, on pasture and in the snails in the course of its infection cycle, so liver fluke epidemiology is very much dictated by the prevailing weather patterns, environmental conditions and farm management practices.

Liver fluke risk can vary dramatically from year-to-year, from farm-to-farm and even from field-to-field. In the past, liver fluke was relatively predictable, with summer infection of snails leading to peak metacercarial challenge to livestock in autumn and clinical disease in winter–spring. This was captured eloquently in Ollerenshaw's Mt Index of fluke risk, based on temperature, rainfall and evapotranspiration (Ollerenshaw and Rowlands, 1959). The model still holds true and forms the basis of the current NADIS Parasite Forecast (https://www.nadis.org.uk/parasite-forecast.aspx). In more recent years, we have seen cool dry springs and relatively hot dry summers lead to lower and later fluke challenge on the ground. Long-term projections of liver fluke risk, based on the Ollerenshaw Mt Index, would suggest a change in seasonality over coming decades, with increased over-winter survival of fluke stages, eggs, cysts and snails on pasture (Fox et al, 2011).

Sustainable control of liver fluke remains a challenge going forward, as liver fluke is very much a moving target. Available diagnostic tests are useful but not perfect; there is still no immediate prospect of a commercial vaccine; the intermediate host mud snails amplify infection and wildlife hosts further disseminate it; some agri-environment schemes may increase fluke risk to livestock and there are increasing reports of resistance to frontline flukicides. This short guide explores sustainable liver fluke control options in cattle against the background of this changing farm landscape.

Control of liver fluke in cattle has been covered in a number of comprehensive reviews relatively recently (Skuce and Zadoks, 2013; Williams et al, 2014). Also, the Control of Worms Sustainably (COWS) group has produced excellent up-to-date resources covering all aspects of liver fluke (and rumen fluke) control in cattle, for farmers, advisors and practitioners. You are referred to the relevant information rather than it being repeated here: https://www.cattleparasites.org.uk

Figure 1. Adult liver fluke, Fasciola hepatica.

Impact of liver fluke on cattle

Cattle often appear clinically unaffected by liver fluke, possibly because the liver is relatively large and the tissue quite tough and fibrous. Acute clinical disease, caused by mass migration of immature fluke, is rare, but not unheard of, in cattle. Most infections tend to be chronic, as a result of a build-up of adult fluke in the bile ducts (*Figure* 3), and the host's attempt to encapsulate them.

Studies attempting to quantify production effects in cattle have produced variable results, with some showing substantial effects of liver fluke on carcass weight, carcass conformation, age at slaughter, weight gain and milk production, while others have found little or no support for effects of fluke (Sanchez-Vazquez and Lewis, 2013; Bellet et al, 2016). Similarly, attempts to quantify the economic impact of fluke on cattle have produced variable results, with estimates of between €6 and €300 per head (Schweizer et al, 2005; Charlier et al, 2012; Carroll et al, 2020).

To address this disparity, the author's team recently conducted a meta-analysis, comparing performance in animals infected with liver fluke with uninfected animals, based on 28 published and unpublished studies in sheep and cattle. Analysis revealed that infected animals had 9% lower daily weight gain and 6% lower live weight than uninfected animals. Effects of fluke infection on carcass weight were negligible (0.6%) although statistically significant, and effects on total weight gain and milk production were non-significant. In general, effects were larger in studies that used experimental infections rather than natural infections, in studies that used young animals, and in studies that measured effects longer after initial infection (Hayward et al, 2021).

In a follow-up study, in order to investigate the impact of natural liver fluke infections in Scottish cattle, kill data from 252 000 cattle slaughtered between 2014–2017 were analysed, 3% of which had liver lesions classed as active fluke infection, 18% had lesions consistent with past infection (historic fluke), and 79% showed no evidence of infection. Animals with fluke were typically 14–18 days older at slaughter than those with no fluke and had 4% lower weight gain. This equated to a small but significant 2% increase in associated greenhouse gas emissions intensity (Skuce et al, 2021). It is important to note that detection of liver fluke or associated lesions at slaughter potentially misses many cases and does not take account of animals that did not make it to slaughter, hence these estimates likely under-represent the true impact of liver fluke on cattle.

Diagnosis of liver fluke in cattle

It is important to understand the diagnostic tests available for liver fluke and what they tell you about the liver fluke status of the animals being tested. Veterinary inspection post mortem remains the most unequivocal method of detection, but inspection of carcasses at the abattoir is also a useful indicator of chronic fluke at least (Mazeri et al, 2016). The earliest indicator of liver fluke infection is the antibody enzyme-linked immunosorbent assay (ELISA), which can be applied to individual blood samples for beef cattle and/or bulk tank milk samples for dairy cows. Animals typically sero-convert within 2 weeks of infection, so this is a very useful test in first season grazing animals. Small groups of 'sentinel' animals (often sheep) can be used to help determine where and when

Figure 2. The liver fluke's mud snail intermediate host, Galba truncatula.

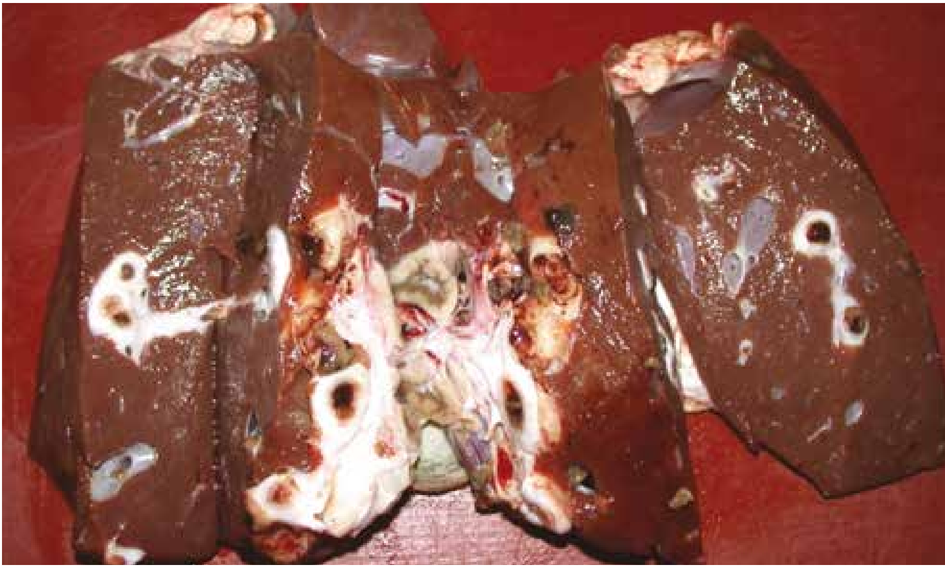

Figure 3. Chronic fluke damage in a bovine liver.

stock have become infected, helping to risk assess the farm and inform treatment decisions, timing and product choice. The main drawback with serological tests in older animals is the persistence of antibodies for weeks/months, even after successful treatment. The next option, in terms of timing, would be the coproantigen ELISA (or cELISA). This is also an immunologically-based test but, rather than detecting anti-fluke antibodies in blood or milk, the cELISA detects fluke secretions (antigen) in faecal samples. It is a very sensitive test, becoming positive approximately 6 weeks post-infection, and responds quickly to successful treatment, allowing for a coproantigen reduction test to determine treatment efficacy (Flanagan et al, 2011). Its main drawback is that the cELISA is best run on individual samples, it does not perform well on composite or mob samples, making it relatively expensive. The main test used in cattle is still the faecal egg count. This is relatively cheap to run but, by default, is only able to detect adult fluke (>10 weeks of age). We have developed a composite FEC for cattle, taking into account the typically low faecal egg count found in cattle samples, to encourage more routine diagnosis and monitoring on-farm (Graham-Brown et al, 2019).

Treatment of liver fluke in cattle

There are currently six actives for treating liver fluke in cattle, namely triclabendazole, closantel, nitroxynil, clorsulon, albendazole and oxyclozanide, At the time of writing, Trodax (nitroxynil) was an option for treating late immature-adult fluke in cattle and sheep, but its manufacturers, Boehringer Ingelheim, have just announced its imminent withdrawal from the market, potentially reducing the options to five actives. In any event, veterinary surgeons will need to be even more careful to use the available actives as sparingly and as strategically as possible (*Figure 4*).

An important point to remember is that not all flukicides kill all stages of fluke. Some, for example triclabendazole, can kill fluke from as young as 2 weeks of age in cattle, depending on the formulation. Others, such as closantel, can kill fluke from approximately 7 weeks of age to adult, whereas the remainder are effectively adulticides, only capable of killing fluke of >10 weeks of age. It is, therefore, vitally important to use relevant diagnostic test results to confirm the age of fluke present in infected animals, to inform treatment decisions and product choice. The reader is referred to COWS' excellent resources for most up-to-date information:

https://www.cattleparasites.org.uk/app/uploads/2020/01/liver-and-rumen-fluke-110120.pdf-.pdf

Another important point to remember is that none of the flukicides is persistent, unlike some of the wormers, so livestock are continually at risk of re-infection if left grazing fluke-infected pasture post-treatment. A further consideration is chemical residues in meat and milk following treatment. All products will have a meat and milk withdrawal period. The latter is particularly significant, and makes liver fluke very difficult to manage on a dairy farm. This is a constantly changing scenario, so the reader is referred to NOAH/VMD updates for the latest information: https://www.cattleparasites.org.uk/app/uploads/2020/11/2020-05-12-NOAH-VMD-flukicides-in-dairy-cattle.pdf

Flukicide resistance

There have been published reports of resistance to closantel in Sweden (Novobilský and Höglund, 2015), and to albendazole in Spain (Alvarez-Sánchez et al, 2006), but the only resistance detected in flukicides to date in the UK is to triclabendazole. It is most likely to have been selected through routine triclabendazole treatment of sheep, but there is still a risk to cattle of acquiring a triclabendazole-resistant fluke infection if co-grazing with sheep on mixed farms. Flukicide efficacy is best assessed using a faecal and/or coproantigen reduction test, as for sheep (Flanagan et al, 2011).

Liver fluke risk and agri-environment schemes

Fluke management has typically focused on routine treatment of stock with chemical flukicides coupled with reducing livestock access to boggy ground through either fencing or drainage. However, some agri-environment options promote the grazing of wetland areas on farms for other environmental benefits associated with these habitats (*Figure* 5). As a result, there is some perceived reluctance among livestock farmers to engage in such schemes for fear of increasing the liver fluke risk to their livestock (Pritchard et al, 2005). That said, some agri-environment schemes encourage fencing off of wet areas, so may be expected to reduce the risk of fluke infection.

Cattle are particularly good 'conservation grazers' as they can maintain the sward at the requisite height for nesting birds etc, and help to prevent the margins from becoming overgrown and inaccessible. They also help break up vegetation and their dung can contribute to soil health and fertility, supporting invertebrate populations, an important food source for wetland birds.

The author's team has recently been investigating fluke risk to livestock under two such agri-environment scenarios, namely cattle grazing marginal saltmarsh to promote natterjack toad habitat, and sheep and cattle grazing around wader scrapes, established to encourage wetland birds. Results to date indicate that livestock were at less risk of fluke infection under these circumstances than they had been in the intensely grazed fields from which they came. That this remains the case requires ongoing monitor-

Figure 4. Good practice and application of fluke pour on at housing. Photo supplied by Norbrook Laboratories.

Figure 5. Cattle exploring a newly-installed wader scrape.

ing and evidence, but does represent a potential win–win, where biodiversity is promoted through conservation grazing, but not at the expense of animal health. A case study, describing this work, is available (Scottish Environment, Food and Agriculture Research Institutes, 2021):

Further environmental considerations

One aspect of sustainable liver fluke control, and parasite control in general, that has received attention recently is the fate of veterinary medicines in the environment. At least some of the frontline wormers and flukicides have the potential to negatively impact on dung beetles, flies and other dung fauna, which provide important ecosystems services, such as improving soil health and as a food source for key wildlife species (Gilbert et al, 2019; Mooney et al, 2021; Sands and Noll, 2021). This can occur when the active ingredients or their metabolites are excreted in the manure and/or urine of treated animals, or leach into the environment as a result of poor storage, application or disposal. It is very important, therefore, that farmers, advisors and veterinary surgeons are aware of any environmental contraindications, and consult appropriate technical advice held within the specific Summary of Product Characteristics (SPC). The Sustainable control of Parasites in Sheep (SCOPS) and COWS groups have recently published a joint statement to this effect (COWS, 2021):

Conclusions

Sustainable liver fluke control remains a challenge going forward, but there is significant room for improvement. Veterinary surgeons need to make best use of all the available tools in their armoury, from regional fluke forecasting, to on-farm risk assessment of fluke, through routine monitoring and diagnostic testing to make informed decisions about if and when to treat and which product(s) to use. The few available flukicides need to be used strategically to best effect, and only treat when necessary. This will help reduce the risk of resistance developing and also reduce the overall levels of veterinary medicines in the food chain and the environment, promoting sustainable fluke control in its broadest sense. LS

KEY POINTS

- Having a working knowledge of the liver fluke lifecycle will help inform what may be happening on-farm at any given time.
- Learn to recognise potential mud snail habitat and be able to risk assess the farm/field for fluke.
- An understanding of what diagnostic tests are available and what they tell you about the fluke infection will help with management of the disease.
- It is useful to know the liver fluke status of the animals and the farm — test, don't guess!
- It is important to know which products work on the farm and which don't — test, don't guess!

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