Are you interested in becoming a recognised expert at OPA screening?

Improving the efficiency of Scotland's sheep farms by supporting control of ovine pulmonary adenocarcinoma (OPA)

Why is the Scottish Government funding this project?
Ultrasound screening remains the only way to detect pre-clinical OPA on farm. Veterinary practitioners with validated expertise will be necessary to support control of OPA including any future accreditation and/or elimination programmes for OPA.

Who should apply?
Veterinary practitioners, based in Scotland, who wish to become part of an cohort of practitioners with validated expertise in transthoracic ultrasound scanning (TUS) and in particular ultrasound screening for OPA. These may be vets that already have considerable expertise in TUS or those just starting out with this technique.
We need enthusiastic participants able to commit to a 2-year programme which includes training at Moredun Research Institute and on local farms, scanning each of 5 farms within or local to your practice 2-4 times during the project and logging the activities and results, submission of lung samples from some of the scanned sheep for diagnostic confirmation, completing an on-line assessment at the beginning and end of the programme. (See next page for further details).

What's in it for you?
The programme will furnish the enrolled vets with advanced skills and a recognition of having attained those specialist skills.
The training and support is free apart from the vet's own time and goes beyond previously available training in supporting the trainee through several years of this work.
The project will provide independent validation of the vet's own scanning results and should lead in the future to an important additional source of practice income with the vet being a member of an "OPA task force" with active promotion of such services to livestock farmers.
Validation of expertise should also mean that these individuals will be appropriate to teach and support future generations of vets (or laypeople) undertaking TUS.

What is involved?

The proposed plan is shown below but is likely to evolve according to discussions with programme participants.

1) Participants will be requested to complete a questionnaire and an on-line test pertaining to interpretation of ultrasonographs in order to establish the base-line level of experience at the start of the course.

2) Participants will be encouraged to join an on-line private social media group for peer support and discussion throughout the programme.

3) Participants will attend a 2-day training course on November 8th and 9th 2023 at Moredun (FOC including overnight accommodation, if required)– to include revision of OPA and ultrasound diagnosis, practical sessions including standardised protocols for ultrasound screening on farm and for postmortem sample collection and submission.

4) Participants will aim to recruit 5 farms at which to conduct ultrasound screening and will ask for consent for the project to purchase a number of sheep post-scanning at market rate. If required, the programme will help support farm recruitment.

5) Participants will be asked to log their ultrasound screening work including farm information (anonymised), number of sheep scanned and number of scan positives and to record all sonographs with suspicion of a lung lesion plus 50 negative scans per farm. (Scanning and recording equipment will be available through the project for use by participants.)

6) Sheep for postmortem will be selected from the submitted sonographs in order to cover a range of OPA stages and other pathologies. Arrangements for euthanasia and lung sample collection will be agreed in advance according to the facilities and the farmer's preference. Lung samples will be posted to Moredun for histopathology. Definitive diagnosis will be reported back to the delegate.

7) On-farm training: upon request PS will join a farm screening day to give additional help and support. Other participants may be invited to attend also.

8) Towards the end of the programme participants will be asked to complete a second on-line test in order to assess learning. Diagnostic efficacy ascertained from PM results will be given to each individual but summarised results for all will be anonymised. Participants will all attend a discussion group to provide expert input on best practice for ultrasound screening for OPA, successes and pitfalls and potential improvements for future training and support of ultrasound scanners.

9) The final phase of the project is to share the knowledge gained. Ideally, participants will present the information to farmers and other vets in their local area. Moredun will support organising this if required. Articles for farming and veterinary publications will be prepared with shared input and authorship anticipated from all involved in the programme.

10) Participants will receive certificates of CPD and those demonstrating competence at ultrasound screening will be awarded a certificate and the option to have their name on a public register of "elite" OPA ultrasound scanners.

For further information and/or to apply to join the programme please contact chris.cousens@moredun.ac.uk

PROJECT PROPOSAL SUMMARY

Improving the efficiency of Scotland's sheep farms by supporting control of ovine pulmonary adenocarcinoma (OPA)

Timeline =24 months. Start date 01 Nov 2023

Project leaders

Dr Chris Cousens, BSc(Hons) PhD, Moredun Research Institute
Dr Phil Scott, BVM&S MPhil DVM&S DSHP DipECBHM DipECSRHM FRCVS RCVS- and European-recognised sheep specialist. Capital Veterinary Services.

Aims

The primary aim of this project is to provide an immediate and a lasting impact on the control of ovine pulmonary adenocarcinoma (OPA) in the Scottish sheep flock thereby increasing the efficiency of sheep farming and reducing its carbon footprint, whilst also improving animal welfare and supporting the rural economy as sheep rearing is especially important in areas of land with marginal use for any other form of food production.

Test-and-cull based on high-throughput whole flock screening by trans-thoracic ultrasound scanning (TUS) has been shown to be a useful tool in the control of OPA, but currently there is a shortage of Scottish vets competent and confident at this procedure. We will address this issue by providing in-depth training and on-going support to a cohort of veterinary practitioners. The major legacy of this project will be a cadre of veterinary practitioners (8-12) who are expert in ruminant ultrasonography and capable of providing a TUS scanning service, and also of training other veterinary practitioners and paraprofessionals in whole flock screening.

Additional benefits of this study are that participating farms are expected to see a marked reduction in annual OPA incidence over the two years' study and beyond, and that new data on OPA prevalence and on the efficacy of ultrasound diagnosis will be generated. A part of the study will assess whether a simple blood test would be a useful adjunct to increase the specificity of TUS.

The direction of this study came from discussion by the Scottish government working group on OPA which consists of vets, scientists, policymakers and farmers.

Background

Ovine pulmonary adenocarcinoma (OPA) is an infectious lung tumour of sheep caused by Jaagsiekte Sheep Retrovirus (JSRV) causing weight loss and increasing severity of respiratory signs over several months. The disease is invariably fatal and has serious welfare implications during the latter stages. Sudden death caused by secondary bacterial infection is not uncommon.

The disease is clearly of concern to flock owners and the number of cases appears to be increasing. However, although there are a number of different sources of data on the incidence of OPA (see table below), it is not possible to combine these to estimate the prevalence of OPA in Scotland.

Source of data	Incidence of OPA	Reference
Passive surveillance	Approx 80 laboratory-confirmed cases p.a.	VIDA
Fallen stock study	5.6% of 107 sheep	Lovatt and Strugnell, 2013
Abattoir study	0.9% of 3,000 cull sheep	Cousens et al., 2015
Abattoir study Republic of Ireland	0.5% of 1,911	Lee et al., 2019
whole flock TUS study	1.1% of 1,084 adult sheep	Davies et al., 2022

Post-mortem examination of the lungs is considered the "gold standard" for OPA diagnosis but examination of gross pathology can give unreliable results even when conducted by board-certified pathologists, therefore histology, and, if necessary, immunohistochemistry (IHC), is required to confirm a diagnosis of OPA.

Clinical examination of OPA is able to identify advanced disease but not earlier cases of OPA although these animals are likely to be a risk of infection to other sheep (Cousens et al., 2008; Scott et al., 2010). Whilst the "wheelbarrow test" is pathognomonic for OPA, it detects only around 60 % of cases (Cousens et al., 2019) and in any case is ill-advised for animal welfare reasons. There is presently no vaccine, routine diagnostic test, or treatment for OPA.

The possible application of transthoracic ultrasonography (TUS) for OPA diagnosis was discussed as long as 25 years ago (Scott and Gessert 1998). More recently, a research project led by Chris Cousens (Moredun) and Phil Scott (Edinburgh University and now Capital Vet Services) and funded by Scottish Government & Clyde Wind Farm Development Fund investigated TUS for rapid on-farm screening for OPA. Rapid TUS of more than 80,000 adult sheep followed by postmortem examination (PME) of 440 animals, including histology and IHC, enabled critical statistical analysis of our scanning protocol (Cousens et al., 2022). It also showed that the within-flock prevalence of OPA can be significantly reduced by test-and-cull based on TUS screening.

In recent years, in addition to working on the research project, Phil Scott has provided TUS scanning as a commercial service. A few other vets are also providing this service to clients. These providers have completed a 1-day continuing education course at Moredun or have self-taught adapting from their experience with ultrasound imaging of other pathologies. None have had the benefit of further training or verification of their findings. We are told that the demand by farmers for whole flock screening outweighs the current availability of vets able to offer this service. An emerging problem is that there is little opportunity for vets undertaking screening for OPA to gain feedback and validation of their results. This has led to a loss of confidence by some vets and for others a poor efficacy as highlighted by recent publications or presentations (e.g. Davies et al., Vet Record, 2022). In addition, we are aware that succession planning is necessary for the provision of training for other vets and potentially for lay-scanners to undertake TUS screening for OPA. To address these issues this project will deliver comprehensive training to a cohort of 8-12 veterinary practitioners keen to implement an OPA control programme throughout Scotland and will provide follow-up support over two years as they develop the necessary skills to undertake whole flock OPA screening with a high degree of sensitivity and specificity. Once a validated log of ultrasound scanning results has been collected, this cohort of practitioners would be

able to supervise other vets learning to scan, and potentially train para-professional scanners. Such lasting expertise will be an important legacy of this project.

A central resource of shared equipment (3 sets of Ultrasound machine, probe and recording equipment) will be purchased and made available so that vets keen to join the scheme are not limited by the availability of equipment within their practice. Additional learning and skills confirmation will be facilitated by recording all lung pathologies using video capture software and submitting those for review and if required, a second opinion, and by enabling significant numbers of necropsies to be performed following on-farm screening. Peer support through forming a scanning cooperative with the opportunity to share experiences as well as to access shared scanning equipment will be a vital component of this programme.

Additionally, a research component will investigate whether a simple blood test would be suitable to support differential diagnosis of lung lesions recognised by US scanning. Data collected during the project will be used to estimate the efficacy of ultrasound scanning diagnosis of OPA, as currently such data is limited to just 2 vets.

Finally, an essential component throughout this project will be to raise awareness about OPA in order to increase uptake of measures to control OPA both within and between flocks.

The goals of this project will be achieved through the following activities:

Part 1: Ultrasound training for veterinary practitioners
1.1 Promotion of the Study and **Recruitment** of Vets
1.2 **Two-day training course** at Moredun Research Institute
1.3 **Ultrasound equipment** will be purchased as a central resource available for use by all participants. To be transferred by courier as and when required.
1.4 **Revision courses** and additional support e.g. farm visits, on additional dates from Autumn 2023 to Autumn 2024.
1.5 A **website** will be established with on-line library of ultrasound video recordings of confirmed pathologies and test panel for self-assessment of sonograph interpretation.
1.6 A social media private group will be set up for **discussion and peer support**.

Part 2: Delivery of on-farm screening including continued training, support and validation.
2.1 Participants will aim to recruit 5 farms from their own area. (We will help with this if required). It is proposed that a minimum of 5,000 sheep scanned per annum at a rate of at least 60 sheep per hour would be the goal to achieve competence.
2.2 A **telemedicine service** will be provided by Phil Scott as second opinion. Discussion of any results/queries will be encouraged
2.3 On-line logging of scanning activities will **corroborate experience.**
2.4 Necropsy of 30-36 sheep per participant over the 2 years (to include full range of suspect OPA pathology) with **feedback to the participant** in order to support learning and confidence.   Compensation will be paid to the farmer for the culled sheep at market rate. Sheep will be euthanased and transported to the nearest suitable location for postmortem examination (PME) and collection of tissue samples from the lungs. Tissue processing and histology (plus IHC when required) will be done at Moredun and the definitive diagnosis will be fed back to the participants for review alongside the photos of gross pathology and the ultrasonograph recordings from the same sheep.

Part 3: New Research

3.1 Lung consolidation in the cranioventral lobes is a typical characteristic of OPA and also of some other pathologies caused by infection. Ultrasonography cannot distinguish the two. The presence of copious amounts of fluid coming from the lungs is indicative of advanced cases of OPA but fluid is often not produced at obvious volumes in early OPA. Moredun will use our archive of serum from verified unaffected, pneumonia or OPA cases to test whether serum proteins associated with inflammation might be able to support differential diagnosis when results from the ultrasonographs are uncertain.

3.2 Information would be gathered during the course of this project regarding the efficacy of ultrasound scanning by different operators through interpretation of sonograph recordings and from PME results. To date the largest study has been from our own work of a single operator, so this new information is vital to planning and implementing future training and potential OPA control schemes.

Part 4: Knowledge exchange

Free and open exchange regarding what ultrasound screening can and cannot do is essential to the success of rolling out a control programme. Increased awareness of OPA is also necessary. The target audience will be farmers, vets and policy makers.

Outputs will include a short film, peer reviewed scientific papers, articles in the farming press and presentations for farmers and/or vets.