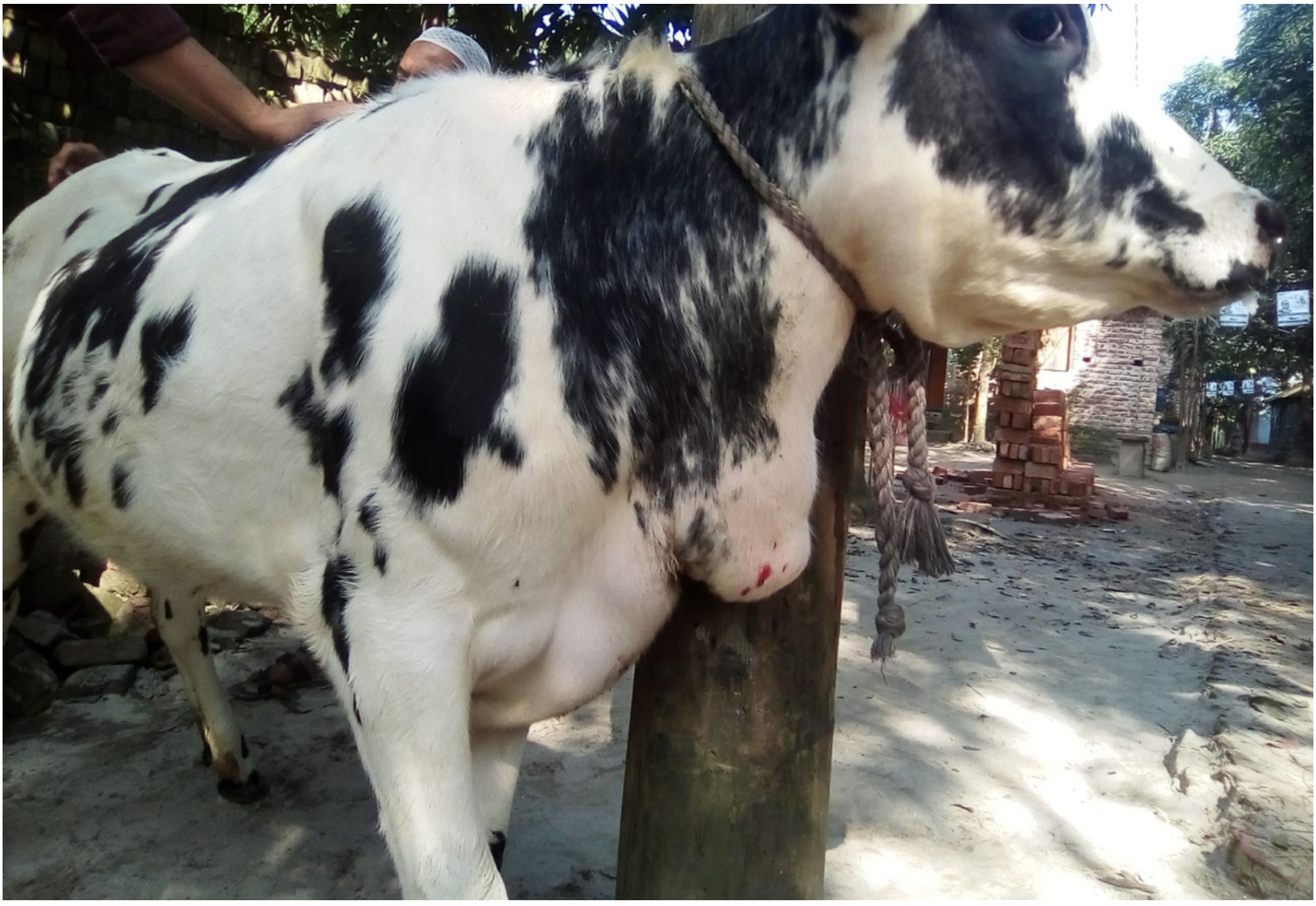
East Coast Fever Vaccine

A recombinant vaccine against East Coast Fever

Published: 27th February 2023



Bdvets, CC BY-SA 4.0 https://upload.wikimedia.org/wikipedia/commons/c/c6/Brisket-edema-theileriosis.jpg

Background

An estimated 25 million cattle are at risk for being infected with East Coast Fever (ECF). Infected animals develop enlarged lymph glands leading to a high fever, become listless, and stop feeding. This may be followed by diarrhoea and mucous discharges from the eyes and nose, and frequently by oedema of the lungs[1].

ECF is common in Central, Eastern and Southern Africa. The mortality may exceed 90% in adult animals, especially imported industrial breeds.

The parasite *Theileria parva* is the causative agent and is transmitted to domestic cattle by ticks. It is believed that ECF evolved from the adaptation of the parasite to tick transmission between cattle.

Currently, cattle are immunized against ECF by the infection and treatment method (ITM). ITM involves treating live *T. parva* sporozoites with long-acting oxytetracycline. ITM provides effective protection against ECF, however the drawbacks to this method include[2]:

- the production of live *T. parva* can be a long process;
- the production and storage of the parasites requires liquid nitrogen which can be in short supply;
- there is a risk that ITM inoculated cattle are *T. parva* carriers and could spread the disease[2]; and
- it is possible to develop *T. parva* resistance.

Variations of the ITM are produced in India, Malawi, Turkey and Zimbabwe. The vaccination cost is approximately US$7 to US$10 a dose; which is a barrier to entry for farmers and limits the distribution and access thereof.

Researchers at the University of Cape Town's Institute of Infectious Disease and Molecular Medicine's Williamson Laboratory[3] have developed a recombinant dual vaccine candidate against East Coast Fever and Lumpy Skin Disease. The vaccine design addresses the need for a clonal, reproducible vaccine that could be produced cheaply enough to improve access in Africa and limit the devastating impact of the disease.

[1] https://www.woah.org/en/disease/theileriosis/

[2] https://doi.org/10.1111/tbed.13417, https://doi.org/10.1016/j.vetpar.2006.08.01,

https://doi.org/10.1016/j.pt.2008.11.007

[3] http://www.idm.uct.ac.za/Anna-Lise_Williamson

Technology Overview

The University of Cape Town have constructed a recombinant Lumpy Skin Disease Virus (LSDV) expressing *T. parva* sporozoite antigen p67 on the surface of on the surface of Bovine Leukemia Virus (BLV) Gag virus-like particles (VLP).

The p67 protein is an ideal subunit vaccine candidate, as it is conserved across cattle-derived *T. parva* strains and can induce the production of sporozoite-neutralizing antibodies in cattle. The antigen is thought to aid in attachment and invasion of the sporozoite into host lymphocytes, although the mechanism is unknown.

Benefits

The benefits that can be attributed to the use of the recombinant chimeric LSDV-ECF vaccine include:

1. **LSDV-ECF dual vaccine**. The dual vaccine could protect vaccinated cattle against LSDV and ECF. The LSDV vector provides prophylactic protection against lumpy skin disease and should provide protection against ECF.
2. **Improved immunogenicity with the presentation of *T. parva* p67 on VLPs.** The display of the *T. parva* p67 on BLV-Gag VLPs should enhance both humoral and cellular immune responses as compared to using soluble p67 antigen. VLPs enable the highly ordered display of antigens on the VLP surface. In this way, presenting antigens that are normally found anchored onto the surface of pathogens may be beneficial, as the antigen might be better stabilized in a more native conformation compared to soluble protein.
3. **Reduced risk of disease transmission and safety**: The recombinant vaccine does not contain live *T. parva* sporozoites. There is therefore a reduced risk of disease transmission through vaccination.
4. **Reduced cost**: Recombinant LSDV vaccines could be manufactured more efficiently and at a lower cost compared to the ITM which requires the production of live *T. parva* sporozoites which is a lengthy and costly process requiring the use of cattle, rabbits and ticks.
5. **Long-lasting protection**: The recombinant LSDV vaccines could provide long-lasting immunity, reducing the need for frequent booster shots and improving compliance with vaccination programs.

Applications

The recombinant LSDV-ECF vaccine could have a significant impact on the health, productivity, and welfare of cattle, and contribute to global food security and economic development.

The recombinant vaccine has the following potential applications in the field of veterinary medicine:

1. **Control of East Coast Fever**: ECF has had devastating effects in Africa. Estimates are that approximately a million cattle die each year due to the disease in the 13 African countries where the virus is endemic. A prophylactic ECF vaccine with the UCT candidate vaccine should contribute toward the management and control of the disease and reduce the estimated USD $300m losses annually.
2. **Improved Food Security**: By controlling ECF, the vaccine can help ensure a stable food supply and reduce food losses for subsistence farmers in particularl.
3. **Facilitating Trade**: By controlling ECF, the vaccine can help the trade of cattle. This will help preserve the economic development in industrial and subsistence farming.
4. **Improved Animal Welfare**: By reducing the incidence of ECF and LSD, the vaccine can help improve the overall welfare of cattle and other bovines, reducing the suffering and death of affected animals.

Opportunity

The University of Cape Town seeks licensees or development partners capable of manufacturing the recombinant vaccine and completing animal trials and registration required for the use of the vaccine and who can sell and distribute the vaccine to users and countries in need of it.

It would be possible to apply for funding jointly with others interested in completing the development and animal trials needed to attract the interest of a commercial partner to commercialize the vaccine.

Patents

- East Coast Fever Antigen Constructs PCT application PCT/IB2022/056970
- East Coast Fever Antigenic Constructs UK provisional application 2110876.6

IP Status

- Provisional patent
- Patent application submitted
- Know-how based

Seeking

- Development partner
- Commercial partner
- Licensing
- Seeking investment