Could we eradicate strangles in equids?

John F. Prescott, MA, VetMB, PhD, and John F. Timoney, MVB, DSc, PhD

Strangles (Streptococcus equi subsp equi infection) is a globally distributed and highly contagious equine scourge first described by veterinarians of ancient Rome. Outbreaks are associated with loss of condition, disruption of training and riding activities, cost of veterinary care, and lethal sequelae including disseminated (bastard) strangles and purpura hemorrhagica. The overall complication rate can be as high as 20% of affected animals, with a case fatality rate of up to 8%.

Control of strangles is based on various approaches, including screening, quarantine, and immunization. Fully effective and safe vaccines providing long duration of immunity are not available, and the task of developing such vaccines, even with complete genome sequence data for S. equi and Streptococcus zooepidemicus, is recognized to be considerable. A recent American College of Veterinary Internal Medicine consensus statement from the United States and United Kingdom on guidelines for treatment, control, and prevention was 12 pages, a length that emphasizes the complexity of control measures. In the United Kingdom, the Codes of Practice Guidelines on Strangles published by the Horserace Betting Levy Board is shorter and, like the consensus statement, focused on dealing with outbreaks. It notes the advisability of informing the relevant breeders’ associations of infection, but acknowledges that there is no legal requirement for this, even for purposes of export. There are no guidelines in Canada agreed to by the horse industry.

Strangles has all the hallmarks of an infection that should and could be eradicated (Appendix 1). The causative agent replicates only in equids and survives only briefly in the environment. It causes serious loss through morbidity and death, as well as through cost and implementation of control measures in outbreaks. Because it is not reportable, its presence may fail to be disclosed for economic or other reasons, and therefore, the disease may be introduced unknowingly causing demoralization and conflict.

Recent work has shown that the organism is a unique biovar or genovar of an ancestral S. zooepidemicus. It appears to be genetically frozen, and unlike most pyogenic streptococcal species, antigenic variation of surface virulence-associated proteins including SeM is slight or absent. In many ways, S. equi is an archetypal relic that could be consigned to history.

Important aspects of the epizootiology of strangles are that most outbreaks are initiated by introduction of horses incubating the disease or recently recovered, that most animals become immune following infection, and that persistent carriers are few. The disease therefore dies out in most affected herds as herd immunity develops. A crucial advance, which points the way to eradication as a feasible option for control of strangles, was the recognition by Newton et al. at the Animal Health Trust in the United Kingdom that the carrier state is usually associated with persistence of infection in the auditory tube diverticulum (guttural pouch). Guttural pouch empyema and chondroids are observable by endoscopy in most persistent carriers. These carriers can be identified by bacteriologic culture or by PCR assay and treated successfully. The chronically infected guttural pouch carrier is possibly the main reservoir of S. equi but accounts for as few as 0.3% (6/1,850) of animals following strangles outbreaks. The figure may be much higher than this in populations of aged horses. It must be stressed, however, that transmission by carrier horses to susceptible animals has rarely been authenticated.

The second advance that points to the feasibility of eradicating strangles is the availability of PCR analysis applied to the SeM gene, a diagnostic test that is two to three times as sensitive as bacteriologic culture when applied to strains. Application to nasal washes rather than swabs is more sensitive. Identification by culture and PCR, followed by isolation and treatment of horses, has been shown to be highly effective in eradicating strangles from endemically affected farms.

The major obstacle to control is that strangles is not a reportable disease, except in the state of Georgia. Making it voluntarily or legally reportable would further its eradication, when combined with a system of detection by culture, PCR assay, and identification and treatment of guttural pouch carriers. The key elements that would be needed to control strangles are making the disease reportable, enforced if necessary by a system of punishments, and instituting a system of health passports signed by veterinarians or ancillary personnel involved in the control program (Appendix 2). The passport system would ensure that the eradication system was low cost, which would decline with time as eradication proceeded from the target population. A health passport system could have a series of other benefits. In a large country, such as the United States, with its great diversity in horse populations and their use, it would probably be best to start an eradication program in individual sectors, such as the racing sector.

From the Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, ON N1G 2W1, Canada (Prescott); and the Gluck Equine Research Center, Department of Veterinary Science, College of Agriculture, University of Kentucky, Lexington, KY 40546 (Timoney).

Address correspondence to Dr. Prescott.
In smaller countries with smaller horse populations, a national program would be more feasible if it were associated with import requirements for other countries. Successful control in one sector would be the impetus to control the disease in other sectors.

A key question is how long do most convalescent animals shed \textit{S. equi}, or, in other words, when is it safe to allow these horses to move into susceptible populations? Three weeks after total recovery, most horses no longer shed \textit{S. equi}, but a small proportion become subclinical, long-term, guttural-pouch–infected carriers. A recent study\textsuperscript{13} that used a nested PCR assay says that \textit{S. equi} DNA can be detected longer in convalescent horses, and that horses in the group without disease may also be infected. Further work is required to confirm how long such animals can be detected by PCR analysis and, most importantly, what proportion is actually harboring \textit{S. equi}. In addition, there is a need to improve the sensitivity of bacteriologic culture of nasal washings, including a need to move away from a two-step nested PCR assay because nested PCR analysis is liable to develop laboratory contamination problems. There may be better targets than the \textit{seM} gene. A rapid test for detection of \textit{S. equi} in nasal washes or swabs would be valuable.

Is eradication of strangles really feasible? We think so for the reasons described. Japan was apparently free of strangles until 1992, when it was imported from the United States.\textsuperscript{14} Strangles need not be an inevitable fate for most horses and should be consigned to the archaeological trash can where it belongs. General recognition of and agreement on the need to eradicate strangles might help focus international research around improved carrier detection and vaccines.

**Appendix 1**

Characteristics of \textit{Streptococcus equi} (strangles) infection of horses that make it desirable and feasible to eradicate.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity of infection</td>
<td>Serious, sometimes fatal, infection in nonimmune animals.</td>
</tr>
<tr>
<td>Host limitation</td>
<td>Infection is limited to equids.</td>
</tr>
<tr>
<td>Environmental survival</td>
<td>Poor.</td>
</tr>
<tr>
<td>Antigenic variation</td>
<td>None or slight, not known to affect immunity or efficacy of vaccination.</td>
</tr>
<tr>
<td>Genetic variability</td>
<td>\textit{S. equi} is a unique genetically frozen genovar or biovar of an ancestral \textit{Streptococcus zoopneumoniae}.</td>
</tr>
<tr>
<td>Carrier state</td>
<td>Uncommon; most horses clear infection within 3 weeks of disease onset.</td>
</tr>
<tr>
<td>Can the carrier state be detected?</td>
<td>Yes, by guttural pouch endoscopy and culture and PCR assay of nasal washings and exudates.</td>
</tr>
<tr>
<td>Can carriers be treated?</td>
<td>Yes, local treatment of guttural pouch.</td>
</tr>
<tr>
<td>Is vaccination effective?</td>
<td>Moderately. No vaccines are ideal but one could be combined with eradication program.</td>
</tr>
<tr>
<td>Does vaccination interfere with detection of carriers?</td>
<td>No, serologic tests are not used in detection of carriers.</td>
</tr>
</tbody>
</table>

**References**


**Appendix 2**

Control of strangles through an eradication program.

<table>
<thead>
<tr>
<th>Control step</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strangles becomes a reportable disease within discrete segments of the horse industry (eg, Thoroughbreds, Standardbreds, Quarter Horses, Saddlebreds, etc)</td>
<td>Program would be mandatory, with published findings and agreed outbreak investigation procedures. Funding would be from a levy on horse sales, betting, or an industry insurance scheme.</td>
</tr>
<tr>
<td>Each horse will be issued a health passport that records, among other things, exposure to strangles.</td>
<td>If not exposed, horses could proceed with racing, breeding, dressage competition, etc. For horses not in the passport scheme, quarantine and screening procedures would be included before they entered susceptible populations (eg, child’s pony on a Thoroughbred farm).</td>
</tr>
<tr>
<td>Investigation of outbreaks would be done by certified personnel under veterinary supervision.</td>
<td>If exposed, institute movement controls. Horse would be monitored for signs of disease during subsequent 2 weeks. Bacterial culture or PCR assay would be performed if signs developed.</td>
</tr>
<tr>
<td>Import-export</td>
<td>Require health passport and recent culture or PCR assay.</td>
</tr>
</tbody>
</table>