



BestBETS for Vets

Supporting veterinary clinicians in making evidence-based decisions



Formalin versus copper sulphate footbath for digital dermatitis in dairy cattle

Clinical Scenario

During a visit to one of your dairy herds, the owner Mr Jordan asks you for advice on his footbathing regime. Digital dermatitis (DD) is endemic in the herd, and he currently footbaths his cows three or four times per week through a solution of approximately 5% formalin. The farm's new herdsman is asthmatic and complains that handling the formalin exacerbates his condition. Additionally Mr Jordan has heard that formalin may be banned in the future because of its carcinogenic affects, so he asks how he would treat his cows if formalin becomes unavailable. Some of your other clients use copper sulphate footbaths rather than formalin and you wonder which is the most efficacious at reducing the clinical signs of digital dermatitis...

3-Part Question (PICO)

In [dairy cows with digital dermatitis] is [a formalin footbath compared to a copper sulphate footbath] more effective at [reducing the clinical signs of disease]?

Search Strategy

MEDLINE(R) In-Process & Other Non-Indexed Citations and MEDLINE(R) 1946 to Present using the OVID interface

(cow.mp. OR cows.mp. OR cattle.mp. OR dairy cow.mp. OR dairy cows.mp. OR dairy cattle.mp. OR bovine.mp OR bovines.mp. OR bos.mp. OR exp Cattle/)

AND

(digital dermatitis.mp. OR DD.mp. OR mortellaro.mp. OR dermatitis digitalis.mp. OR exp Digital Dermatitis/)

AND

(formalin.mp. OR formaldehyde.mp. OR exp Formaldehyde/ OR copper sulphate.mp. OR copper sulfate.mp. OR CuSO4.mp. OR footbath*.mp. OR foot bath*.mp. OR footdip*.mp. OR foot dip*.mp. OR exp Copper Sulfate/)

CAB Abstracts 1910 to Present using the OVID interface

(cow.mp. OR cows.mp. OR cattle.mp. OR dairy cow.mp. OR dairy cows.mp. OR dairy cattle.mp. OR bovine.mp. OR bovines.mp. OR bos.mp. OR exp cows/ OR exp cattle/ OR exp dairy cattle/)

AND

(digital dermatitis.mp. OR DD.mp. OR mortellaro.mp. OR dermatitis digitalis.mp.)

AND

(formalin.mp. OR formaldehyde.mp. OR exp Formaldehyde/ OR copper sulphate.mp. OR copper sulfate.mp. OR CuSO4.mp. OR footdip*.mp. OR foot dip*.mp. OR footbath*.mp. OR foot bath*.mp. OR exp copper sulfate/)

Search Outcome

MEDLINE

- 51 papers found in MEDLINE search
- 48 papers excluded as they don't meet the PICO question
- 0 papers excluded as they are in a foreign language
- 0 papers excluded as they are review articles/in vitro research/conference proceedings
- 3 total relevant papers from MEDLINE

CAB Abstracts

- 145 papers found in CAB search
- 138 papers excluded as they don't meet the PICO question
- 0 papers excluded as they are in a foreign language
- 4 papers excluded as they are review articles/in vitro research/conference proceedings
- 3 total relevant papers from CAB

Total relevant papers

3 relevant papers from both MEDLINE and CAB Abstracts

Comments

A systematic review has been published on the use of copper sulphate footbaths. However, as it does not fully answer the PICO question for this BET, it has not been included. If you want to find out more, the reference is:

Thomsen PT, (2015). Short communication: Efficacy of copper sulfate hoof baths against digital dermatitis—Where is the evidence? *Journal of Dairy Science* **98**: 2539-2544.

A second systematic review (Jacobs et al. 2019) containing the 2 randomised controlled trials appearing in this BestBET has been included as it contains new network analyses comparing the two preparations of interest.

Summary of Evidence

Laven & Hunt (2002) UK

Title: Evaluation of copper sulphate, formalin and peracetic acid in footbaths for the treatment of digital dermatitis in cattle.

Patient group: Lactating Holstein dairy cows on a single farm

Study Type: Randomised controlled trial

Outcomes:

- Mean lesion score using a self-created scoring system on Day 0, 4, 7 and 21
- Percentage of lesions present compared with Day 0 and other days of treatment

Key Results:

- Significant reductions in lesion scores across time with all treatments; mean lesion score was significantly less on Day 7 and Day 21 when compared to Day 0
- No statistically significant differences between treatments, or between treatments over time
- No significant differences between treatments in the percentage of lesions remaining at any time

Study Weaknesses:

- Aims not very specific
- Not sure if randomisation is adequate
- Unknown whether scoring system has been validated, and unknown how scores are calculated
- Unknown whether outcomes were assessed blind
- No sample size calculation carried out; they used cows on one farm only
- Not known whether ethical approval was obtained
- Not enough detail in methods for them to be repeated
- It is unknown whether the groups were comparable prior to intervention
- Missing animals were not accounted for
- Negative findings were not really discussed
- Results relate only to hindfeet

Attachment:



Evidence appraisal (/soe_attachments/231/2829-Critical appraisal - Randomised Controlled Trial_Laven and Hunt 2002 Final_18.06.20_Updated_10.09.20.pdf)

Holzhauer et al. (2012) The Netherlands

Title: The effect of an acidified, ionized copper sulphate solution on digital dermatitis in dairy cows

Patient group: Single commercial Holstein-Friesian herd - 110 cows

Study Type: Randomised controlled trial

Outcomes:

- Only hind feet were assessed
- Presence and severity of digital dermatitis lesions using a standardised published scoring system - statistical analysis focused only on presence or absence of ulcerative lesions (M2 classification)
- Interdigital dermatitis
- It states that there were other outcomes measured which were not reported in the study, e.g. heel erosion, other infectious and non-infectious lesions

Key Results:

- Results presented here relate to the curative effects of the two treatments; in the study they also looked at the preventative effects, the results of which are not relevant for our PICO question and are therefore not assessed in this BET
- At the end of the study, 3/106 copper sulphate treated cows had ulcerative lesions (M2 classification) on their hind claws compared with 14/106 formalin treated cows
- It was stated that in relation to the survival analysis there was no significant difference between the two groups in curative effect on ulcerative lesions in relation to the use of chlortetracycline spray (Hazard ratio 1.5; P=0.23) - our interpretation of this is that there was no significant difference between the two groups in relation to their curative effect because chlortetracycline spray was used on the ulcerative lesions (and therefore could confound the results)
- It was stated that in relation to the transitional logistic regression analysis there was no significant difference seen between two observations for cure rate for claws treated with copper sulphate or formalin

Study Weaknesses:

- Single herd involved
- Stated that all animals had been treated previously with formalin and copper sulphate prior to the study commencing, which could imply that cases may be more likely to be refractory towards the treatments tested in the study
- Animals with ulcerative lesions were all treated with chlortetracycline spray in addition to footbathing - this makes it difficult to assess the true differences between the groups in relation to the interventions administered in the study
- Not stated if outcomes or interventions were assessed or undertaken blind
- No sample size justification was given
- There was not a statistical significance level stated in the methods
- Little comparison made between the two groups prior to the intervention being given - no information on age of animals, parity, milk yield etc.
- It states that some animals were culled and new ones introduced across the study, but there is no information given as to how many were lost or gained between each time point
- It was not stated whether any side effects of the intervention occurred
- In the discussion the authors state that the cure rate of the ulcerative lesions were largely affected by the topical spray - the use of the topical spray introduces confounding to the study and limits the interpretation of the results in relation to cure rate
- In the discussion the authors also claim that using each animal as its own control (i.e. administering both treatments on different hooves within the same animal) would bias the study towards not finding an effect if infections were clustered within animals
- The study was funded by the manufacturers of the copper sulphate solution, but a conflict of interest statement outlines that the study was undertaken independently of the company

Attachment:

Evidence appraisal (/soe_attachments/231/4136-Critical appraisal - Randomised Controlled Trial_Holzhauser et al. 2012_Final 18.06.20.pdf)

Jacobs et al. (2019) Canada

Title: Effect of footbath protocols for prevention and treatment of digital dermatitis in dairy cattle:
A systematic review and network meta-analysis

Patient N/A

group:

Study Systematic review and meta-analysis

Type:

- Evaluation of studies assessing a number of footbath protocols (excluding antibiotic footbath treatments) for the treatment and prevention of digital dermatitis

Outcomes:

- Included studies using preparations such as formalin, copper sulphate, sodium hypochlorite, peracetic acid and a number of commercial preparations

Key Results:

- The pairwise comparisons between formalin and copper sulphate in the network meta-analysis resulted in wide credibility intervals due to small sample sizes, therefore a definitive result could not be obtained

Study Weaknesses:

- A review protocol was not constructed or registered
- Despite both non-randomised controlled studies and randomised controlled studies being included, only the inclusion of randomised controlled studies was justified
- No date was given as to when the search was carried out and therefore the length of time between searching for studies and when the review was published
- Review authors did not perform data extraction in duplicate
- A list of excluded studies was not provided in the manuscript
- Funding sources for the various studies were not stated
- The authors did not justify why a meta-analysis was undertaken on such a diverse data set, although they did use a weighted technique to combine the study results
- The authors included the majority of studies identified from the systematic review in the meta-analyses, and did not assess the impact of including those studies which had a high risk of bias
- The authors did not state whether there was investigation into why each of the studies that were included in the review had such different findings and therefore what the impact of this variation may have had on the results of the review
- No investigation of publication bias was carried out

Attachment:



Evidence appraisal (/soe_attachments/231/4137-AMSTAR-2_Jacobs et al. 2019_Final

18.06.20.pdf)

Comments

This is an updated version of the BET originally published in May 2014 by Marnie Brennan and Jenny Stavisky.

The original BET included Laven and Hunt (2002) and Holzhauer et al. (2012). The appraisals for these papers have been added, and new appraisals and assessments for Jacobs et al. (2019) has been added.

There were other papers found which could be of relevance (Logue et al. 2012), but it was not clear whether the preparations used were mixed compounds, or were the same as those in our BET.

The Holzhauer et al. (2012) paper used an acidified, ionized copper sulphate solution; it is unknown whether the copper sulphate solution in the Laven & Hunt (2002) paper was acidified and/or ionized.

Our outcome of interest focused on reducing the clinical signs of disease and not the prevention of lesion formation.

Comparisons with other footbathing products suitable for treating digital dermatitis would be useful topics for other BETs.

Bottom line

There is insufficient evidence within these studies to conclude whether treatment of digital dermatitis with formalin or copper sulphate footbaths results in a superior reduction of clinical signs in dairy cows.

Disclaimer

The BETs on this website are a summary of the evidence found on a topic and are not clinical guidelines. It is the responsibility of the individual veterinary surgeon to ensure appropriate decisions are made based on the specific circumstances of patients under their care, taking into account other factors such as local licensing regulations. **Read small print (/disclaimer)**

References

Laven RA, Hunt H (2002). Evaluation of copper sulphate, formalin and peracetic acid in footbaths for the treatment of digital dermatitis in cattle. *Veterinary Record* **151**: 144-146.

Holzhauer M, Bartels CJ, Bergsten C, van Riet MMJ, Frankena K, Lam TJGM, (2012). The effect of an acidified, ionized copper sulphate solution on digital dermatitis in dairy cows. *The Veterinary Journal* **192**: 659-663.

Jacobs C, Beninger C, Hazlewood GS, Orsel K, Barkema HW, (2019). Effect of footbath protocols for prevention and treatment of digital dermatitis in dairy cattle: A systematic review and network meta-analysis. *Preventive Veterinary Medicine* **164**: 56-71.

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