FACTORS IN CURE OF SUBCLINICAL S. AUREUS AFTER DRY COW THERAPY

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INTRODUCTION

Drying off cows with antibiotics is carried out to cure subclinical mastitis
and to prevent new infections. The cure rate of pathogenic streptococci in
the udder is about 90% in the Netherlands. For S. aureus this is much lower
(average about 60%). Various factors, which affect this rather low cure rate
are already discussed (4,5). In this paper the results are presented of a
detailed statistical analysis of the cure rate of 406 S. aureus infected
quarters from 283 cows on 73 farms.

MATERIAL AND METHODS

The data in this study were a meta analysis of five clinical trials regar-
ding drying off cows with antibiotics (1,4,5). Only cows with at least one
quarter infected with S. aureus were included in the present study. Prior to
drying off, at approximately 2-4 weeks, aseptically taken individual quarter
milk samples were obtained twice from each cow. A quarter was determined as
being infected when the organism was isolated at both sampling. In the event
of an inconsistent result, a third sample was examined to confirm the
diagnosis. At drying off the cow was resampled. For each S. aureus infected
quarter there were always at least 2 samples S. aureus positive before
drying off.On the first and fifth day after calving the cow was sampled and,
in the event of an inconsistent result, a third sample was taken. Bacterio-
logical culturing and identification was done according to the standards of
the International Dairy Federation (2). A quarter was considered as being
cured when the organism, isolated at drying off, was disappeared in all
samples at calving.

A non-infected quarter at drying off but infected at calving was called a
new infection. When a quarter was infected at drying off but infected with
an other organism at calving, it was also defined as a new infection.

Additional data were collected per quarter (quarter localisation, mean
somatic cell count (SCC) before drying off and number of samples that were
S. aureus positive before drying off), per cow (age, number of quarters
infected with S. aureus before drying off and length of the dry period) and
per herd (prevalence of S. aureus infections, hygiene score). At the start
of each trial all cows of the participating herds were sampled to estimate
the prevalence of S. aureus infections. The hygiene of the cubicles and of
the milking parlor were assessed as was the faecal contaminations of the cow
with emphasis on the udder (bad = 1, average = 2, good = 3).

A total of 406 S. aureus infected quarters from 283 cows on 73 farms were
eligible for inclusion in this study. Not all quarters had complete informa-
tion on all items. Therefore less observations had to be used in some of the
analysis. Data were analysed on quarter, cow and herd level. The probability
of a bacteriological cure was modelled using multivariate logistic regressi-
on (3).

At herd level the reduction in prevalence of infection was modelled using linear regression. The initial logistic regression models included all variables defined previously, in addition dummy variables (n = 5) to account for trial effects were forced into all regression models.
A backward stepwise procedure was used to select the final regression model. The likelihood ratio test (3) was used to decide on statistical significance of variables. Significance was evaluated at the p = .05 level. The logistic regression model may be used to calculate expected probabilities of bacteriological cure given the characteristics of a quarter or a cow. Also, given the regression parameter of a logistic regression model an Odds Ration may be calculated. This Odds Ration expresses the relative probability of cure for animals with a riskfactor present versus the animals without this riskfactor.

RESULTS

Descriptive data of the infected quarters, cows and herds are in table 1 and 2. Results of the logistic regression model are shown in table 3.

The average cure rate of individual quarters subclinically infected with S. aureus at drying off was 65.8%. The cure rate was highest in young cows with one infected quarter and with a somatic cell count below 1.10^6/ml.
Variables predicting the probability of a bacteriological cure in a quarter were log SCC (linear and quadratic term), presence of other S. aureus infected quarters in same cow, infection in a hind quarter, and number of samples infected with S. aureus before drying off. The probability of cure decreased with increasing cell count, decreased when another infected quarter was present in the same cow, when the infection was in a hind quarter, and decreased with a higher percent of samples S. aureus positive before drying off.

Table 1. Influence of the age, the number of S. aureus infected quarters per cow and the somatic cell count on the cure rate of S. aureus after drying off with antibiotics.

	number	cure (%)	new infections (%)
age: (in months)			
48 and lower	77	63 (81.8)	– (–)
49-72	123	89 (72.4)	2 (1.6)
73-96	109	62 (56.9)	2 (1.8)
96 and higher	97	53 (54.6)	5 (5.2)
number of S. aureus infected quarters:			
1 quarter	205	149 (72.7)	7 (3.4)
2 quarters	140	82 (58.6)	2 (1.4)
3 quarters	45	27 (60.0)	– (–)
4 quarters	16	7 (56.3)	– (–)
somatic cell count			
below 10^6/ml	97	82 (84.5)	1 (1.0)
above 10^6/ml	319	185 (58.0)	8 (2.5)

Table 2. Descriptive data of infected quarters, cows and herds.

	quarter	cow	herd
% front quarters	39		
Mean ln (SCC)	7.6 (1.1)[1]	6.9 (.97)	
Samples S. aureus positive before drying off	2/4 74 2/3 143 2/2 191		
More than one S.aureus quarter per cow	49%	31%	
Length of dry period (days)		62 (15)	
Age of calving (years)		6.0 (2.2)	
S. aureus prevalence before drying off			17.3%

[1] Mean and standard deviation

Variables predicting complete bacteriological cure of a cow were log SCC (linear and quadratic), age of the cow, and the presence of more than one infected quarter. The probability of a cure decreased with increasing SCC. The probability of cure decreased with increasing age (table 1), and cows with more than one quarter infected were .57 times less likely to be cured than animals with one infected quarter (table 3).
The dry period length was not important in the outcome of infection.

Table 3. Results of final logistic regression model on probability of cure in quarters resp. cows.

Variable	Quarter model			Cow model		
	Coefficient	SD	OR	Coefficient	SD	OR
Constant	−5.8	4.1		−8.6	7.2	
LnSCC linear	3.6	1.4		4.0	2.0	
LnSCC quadratic	−.37	.11		−.32	.14	
Hindquarter	−.67	.26	.51			
Other S. aureus quarter samples positive before drying off	−.35	.16	.70			
Age in years				−.20	.07	.82
More than one S. aureus infected quarter				−.56	.32	.57

Goodness of Fit results

	Quarter model	Cow model
Deviance	412.1	271
Degrees of freedom	393	277.5
P−value	.24	.38

The prevalence reduction in the herd was only influenced by the prevalence of infection before drying off. The prevalence reduction increased with increasing infection before drying off. The level of hygiene in the farm did not have a significant effect on the reduction of prevalence.

DISCUSSION

A reasonable impression of the cure rate of subclinical S. aureus infections at drying off is obtained after treatment of 60 S. aureus infected quarters (4). All the above mentioned factors (and maybe others) should be considered when judging the efficacy of a dry cow treatment.
Two of the observed risk factors, SSC and age, are readily available from milk test data. The results of this study can then be used to predict the treatment succes in individual cows. It is then possible to decide whether dry treatment should be considered, or other options (like culling) should be contemplated.

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SUMMARY

An analysis was made of the data of five clinical trials regarding drying off cows with antibiotics. Only cows with one or more quarters subclinically infected with S. aureus were included. All cows were sampled at least twice before drying off. A quarter was determined as being infected when S. aureus was isolated at least twice.
Data of 406 S. aureus infected quarters from 283 cows on 73 farms were available.

Data were analysed on quarter, cow and herd level. Variables predicting the probability of a bacteriological cure in a quarter were log somatic cell count, presence of other S. aureus infected quarters in the same cow, infecton in a hind quarter, and percent of samples infected with S. aureus before drying off. The probability of cure decreased with increasing cell count, decreased when another infected quarter was present in the same cow, when the infection was in a hind quarter, and decreased with a higher percent of samples S. aureus positive before drying off.

Variables predicting complete bacteriological cure of a cow were log somatic cell count, age of the cow, and the presence of more than one infected quarter. The probability of a cure decreased with increasing SCC. The probability of cure decreased with increasing age, and cows with more than one quarter infected were 0.57 times less likely to be cured than animals with one infected quarter.

The prevalence reduction in the herd was only influenced by the prevalence of infecton before drying off. The level of hygiene in the farm did not have a significant effect on the reduction of prevalence.

RESUME

Une analyse a été réalisée à partir des données issues de 5 essais cliniques relatifs aux traitements antibiotiques hors lactation chez la vache. N'ont été incluses que des vaches présentant un ou pluieurs quartiers infectés de façon subclinique par S. aureus. Toutes les vaches ont été prélevées au moins 2 fois avant tarissement. Un quartier a été considéré comme étant infecté lorsque S. aureus a été isolé au moins 2 fois. Des données sur 406 quartiers infectés par S. aureus, représentant 283 vaches issues de 73 élevages étaient exploitables.

Les données relatives aux quartiers, aux vaches et aux élevages ont été analysées. Les variables prédisant la probabilité de guérison bactériologique d'un quartier étaient le log du comptage des cellules somatiques (CCS), la présence d'autres quartiers infectés par S. aureus sur la même vache, l'infection d'un quartier postérieur, et le pourcentage de prélèvements infectés par S. aureus avant tarissement. La probabilité de guérison diminuait lorsque le comptage cellulaire augmentait, lorsgu'un autre quartier infecté était présent sur la même vache, lorsqu'un quartier postérieur était infecté et lorsque le pourcentage de prélèvements contaminés par S. aureus avant tarissement était important.

Les variables prédisant la guérison bactériologique complète d'une vache étaient le log du CCS, l'âge de la vache, la présence de plus d'un quartier infecté. La probabilité de guérison était inversement proportionelle au CCS. La probabilité de guérison diminuait lorsque l'âge de l'animal augmentait et les vaches avec plus d'un quartier infecté avaient 0.57 fois moins de chance d'être guéries par rapport aux animaux ne présentant qu'un quartier atteint.

Au niveau de l'élevage, la réduction de la prévalence dépendait seulement de la prévalence de l'infection avant tarissement. Le niveau d'hygiène de l'élevage n'avait pas d'effet significatif sur la réduction de la prévalence.

ZUSAMMENFASSUNG

Eine Analyse von Informationen aus 5 klinischen Experimenten betreffend des Trockenstellen von Kühen mit Antibiotica wird beschrieben. Nur Kühe mit ein oder mehreren subklinisch, mit S. aureus infizierte Vierteln sind untersucht worden. Von allen Kühen sind mindestens 2 Proben gezogen worden, vor dem Trockenstellen. Ein Viertel sei infiziert, wenn mindestens 2x im gleichen Viertel, S. aureus isoliert wurde. Informationen von 406 S. aureus infizierte Viertel von 283 Kühen auf 73 Bauernhöfen wurden gebraucht.

Diese Informationen wurden analysiert nach Viertel, Kuh und Herde. Eine mögliche bakterielle Heilung eines Viertels wurde beeinflusst vom log Zellgehalt, den Menge an S. aureus infizierte Viertel pro Kuh und von der Infizierung eines Hinterviertels. Weiter hatte der Prozentsatz der Proben die vor dem Trockenstellen infiziert waren mit S. aureus, Einfluss auf eine mögliche bakterielle Heilung. Die Heilungschance nahm ab bei einem erhöhten Zellgehalt, wenn mehrere Viertel pro Kuh infiziert waren und wenn ein

Hinterviertel infiziert war. In dem höheren Prozentsatz der Proben vor dem Trockenstellen <u>S. aureus</u> positiv war, war die Heilungschance geringer.

Die vollständige bakterielle Heilung einer Kuh wird beeinflusst vom log Zellgehalt, Alter der Kuh und wenn mehrere Viertel infiziert sind.
Die Heilungschance nahm ab bei zunehmenden Zellgehalt und zunehmenden Alter, währenddessen die Chance auf eine Heilung mit 0,57 abnahm, wenn mehrere Viertel infiziert waren.

Der Rückgang der Prävalenz in einer Herde wird nur beeinflusst durch die Prävalenz von der Infektion vor dem Trockenstellen.
Der Rückgang der Prävalenz war weniger bei zunehmenden Infektionsdruck vor dem Trockenstellen. Den Hygiene masstab auf dem Bauernhof hatte keinen signifikanten Effekt auf die Rückgang der Prävalenz.