Prevalence and Antibiotic Therapy of Teat Canal Infections During the Dry Period of Dairy Cows

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Introduction

Most udder infections caused by *Staphylococcus aureus, Streptococcus agalactiae* and *Staphylococcus epidermidis* originate in the teat canal (1, 4). These and other organisms first have to establish themselves in the teat canal, by colonizing it, before they can enter the teat cistern (1). In addition to the teat canal, the skin of the udder and teats constitutes the main source of *S. aureus* involved in udder infections (3, 6).

Dry cow therapy reduces the incidence of new udder infections in the dry period (5) and is more effective than lactation therapy in eliminating udder infections (2). For these and economic reasons we have investigated the feasibility of eliminating colonized bacteria from the teat canal of dry cows, by the use of minimal quantities of antibiotics, in an attempt to reduce the source and the occurrence of new udder infections during the dry period.

Materials and Methods

Teat canal swabs and foremilk samples

Miniature teat canal swabs were made by wrapping good quality highly absorbent cotton wool for a distance of 3-4 mm around the tip of 3.5 cm long slim wooden toothpicks. Swabs were wrapped in aluminum foil and sterilized in an autoclave.

Before sampling, the teats were washed, dried with a sterile disposable paper towel and the orifices disinfected by rubbing with cotton swabs soaked in 70% alcohol. The first three jets of foremilk were discarded before a quarter sample was collected aseptically into a sterile 5 ml 'monoplast' tube. The teat canal was then swabbed by inserting the cotton wool tipped miniature swab into the teat canal for a distance of 3-4 mm whereafter it was placed in sterile 5 ml 'monoplast' tube to facilitate transport.

Foremilk samples and teat canal swabs were obtained immediately before administration of antibiotics and again 1-5 days after calving (see below) for bacteriological analysis.

Before implementation of our sampling regime we established the effectivity of the disinfection process by sampling and culturing 50 teat tips subsequent to disinfection.

All samples were transported on ice and analysis proceeded within 6 hours of sampling.

Isolation and Identification of Bacteria

Facultative and microaerophilic bacteria were isolated by streaking a loopful (±0.01 ml) of foremilk sample onto each of two blood triptose (BT) plates. Both plates were incubated at 37°C for 48 h, one of them under microaerophilic conditions. The swabs were similarly streaked and cultured. In each case 0.1 ml of foremilk sample and the aseptically removed tip of swabs were separately enriched by incubation in 5 ml serum broth. This served as a back-up in those cases where no growth materialized on BT-plates. Speciation was done according to the methods and criteria described by Cowan and Steel (1971).

Specific culture of anerobic bacteria was excluded for practical reasons. For the purpose of this report it is assumed that the presence of mastitis bacteria in a quarter milk sample reflects bacterial infection of the udder's secretory tissue.

Dry Cow Teat Canal Therapy

Procain benzyl penicillin and dihydrostreptomycin sulphate was diluted in glycerine and methyl paraben (K-Y lubricating jelly†) to a concentration of 6 mg and 8 mg antibiotic respectively per 0.1 ml diluent. Therapy consisted of deposition of 0.1 ml quantities of the approximately diluted antibiotic into the teat canal of cows in the first

experimental group (Table 1).

In a second experimental group (Table 2) we used 0.25 ml of the preparations containing 14 mg procain benzyl penicillin and 19 mg dihydrostreptomycin sulphate. In both instances the relevant quantities of prepared antibiotics were instilled after disinfection of teat tips, by forcing the antibiotic into the teat canal by means of tuberculin syringe. This was done immediately after the last milking at drying-off.

Dry Cow Treatment

A third group of cows received standard drying-off treatment: 10 g of a preparation containing procain benzyl penicillin (4.9% m/m) and dihidrostreptomycin sulphate (6.5% m/m) was deposited in the gland cistern via the teat canal after disinfection of teat tips and immediately after the last milking.

The effect on teat canal flora of treatment of teat canals with 0.1 ml of a penicillin-streptomycin preparation (6 mg and 8 mg respectively) is reported in Table 1. Although no significant difference was found between foremilk quarter samples analyzed before and after treatment (percentage bacteriologically clean foremilks: 90.7% and 93% respectively, swab culture showed the percentage bacteriologically clean teat canals, to have improved from 67.5% to 86%.

As illustrated in Table 2, a considerable improvement in the bacteriological status of both quarters and teat canals was accomplished when the dosage was increased to 0.25 ml containing 14 mg and 16 mg penicillin and streptomycin respectively in the mixture. Bacteriologically clean quarter milk samples increased from 66% to 94.4% and teat canal swabs from 33% to 80.5%.

In Table 3 it can be seen that standard dry cow treatment did not significantly improve the prevalence of bacteriolo-

RESULTS

TABLE 1. Effect of 0,1 ml Pen-strep* mixture treatment on quarter/teat canal flora of Group 1 cows (43 quarters).

	Before treatment at drying-off				After treatment, 1-5 days after calving			
	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)
Bacteriological status of quarters/teat canal	4(9,3)	39(90,7)	14(32,5)	29(67,5)	3(7)	40(93)	6(14)	37(86)
Bacteria Isolated:								
S. aureus	2(4,7)		9(20,9)		3(7)		4(9,3)	
S. agalactiae	2(4,7)		3(7)				1(2,3)	
Corynebacterium bovis			1(2,3)				1(2,3)	
Mixed infections			1(2,3)					

* 6 mg procain benzyl penicillin and 8 mg dihydrostreptomycin sulphate per 0,1 ml dose.
+ = bacteria present
+ = Johnson and Johnson, East London.

TABLE 2. Effect of 0,25 ml Pen-Strep* mixture treatment of Quarter/Teat canal. Flora of Group 2 cows (36 quarters).

	Before treatment at drying-off				After treatment, 1 to 5 days after calving			
	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)
Bacteriological status of quarters,teat canals	12(33)	24(66)	24(66)	12(33)	2(5,5)	34(94,4)	7(19,4)	29(80,5)
Bacterial Isolated:								
S. aureus	11(30,5)		17(47,2)		2(5,5)		5(13,8)	
S. agalactiae	1(2,8)		3(8,3)				1(2,8)	
C. bovis			1(2,8)					
S. epidermidis			1(2,8)					
Mixed infections			2(5,6)				1(2,8)	

* 14 mg procain benzyl penicillin and 19 mg dihydrostreptomycin per 0,25 ml dose
+ = bacteria present
-- = bacteria absent

gically clean quarter milk samples (66.3% to 68.8%). However the prevalence of clean teat canal swabs improved from 42.2% before treatment to 59.1% thereafter.

The results in Table 4 indicate that comparatively little change took place in the relevant flora of the untreated control cows. Although 65% of foremilk samples were bacteriologically negative 1-5 days after calving, as compared to 60% at drying-off, only 30% of the teat canals were clean at calving compared to 35% at drying off.

Discussion

It is evident from the results obtained in this study that considerable improvement in the bacteriological status of quarters and teat canals can be accomplished during the dry period, by prophylactic treatment of teat canals at drying off, using minimal quantities of appropriate antibiotics. We found that a single installation of 0.25 ml of a preparation containing 14 mg procain benzyl penicillin and 19 mg dihydrostreptomycin into the teat canal increased the number of bacteriologically clean quarters, as monitored by foremilk samples, by 43% (66% to 94.4%) over the dry period. The increase in the number of canals, as evidenced by teat canal swab examination, was even more remarkable: a change from 33% to 80.5% representing an improvement of 144%!

The smaller amounts of penicillin-streptomycin mixture (6 mg and 8 mg respectively) only significantly improved the incidence of clean teat canals by 27.4%. Similarly, standard dry cow only treatment improved the incidence of clean teat canals by 40%.

One of the cows in group 1 (Table 1—lower dosage) and one from group 3 (Table 3—standard dry cow treatment) developed clinical mastitis at calving. None from group 2 (Table 2—optimal dosage) developed mastitis between days 1-5 after calving. It thus appears from these results that the lower antibiotic dosage (Table 1) and the standard dry cow treatment (Table 3) were about equally effective in eliminating colonization of the teat canal during the dry period. The optimal dose of antibiotic (Table 2), however, improved

TABLE 3. Effect of 10 g Intramammary application of Pen-strep* on quarter/teat canal flora of Group 3 cows (83 quarters).

	Before treatment at drying-off				After treatment 1-5 days after calving			
	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)
Bacteriological status of quarters/teat canals	28(33,7)	55(66,3)	48(57,8)	35(42,2)	26(31,3)	59(68,8)	34(40,9)	49(59,1)
Bacteria Isolated:								
S. aureus	11(13,2)		23(27,7)		10(12)		10(12)	
S. agalactiae	3(3,6)		3(3,6)		3(3,6)		3(3,6)	
C. bovis	7(8,4)		9(10,8)		8(9,6)		10(12)	
S. epidermidis	2(2,4)		8(9,6)		1(1,2)		6(7,2)	
E. coli	4(4,8)		3(3,6)		3(3,6)		3(3,6)	
Mixed infections	1(1,2)		2(2,4)		1(1,2)		2(2,4)	

* 4,9 % (m/m) Procain benzyl penicillin and 6,5 % (m/m) dihydrostreptomycinsulphate per 10 g dose.
+ = bacteria present
− = bacteria absent

TABLE 4. Bacteriological status of quarters/teat canals of untreated control cows (20 quarters).

	At drying-off				After calving			
	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)	Quarter Foremilk +(%)	−(%)	Teat canal Swabs +(%)	−(%)
Bacteriological status of quarters/teat canals	8(40)	12(60)	13(65)	7(35)	7(35)	13(65)	14(70)	6(30)
Bacteria Isolated:								
S. aureus	6(30)		7(35)		5(25)		7(35)	
S. agalactiae	2(10)		2(10)		2(10)		2(10)	
C. bovis			1(5)				1(5)	
S. epidermidis			2(10)				3(15)	
Mixed infections			1(5)				1(5)	

+ = bacteria present
− = bacteria absent

both the bacteriological status of sampled quarter milk and the teat canal swabs. Futhermore, no cases of mastitis were recorded for this group during the first few days after calving. This aspect, however, will have to be studied in quarter detail.

Since the optimum dose required for effective control of an important source of udder infections is about 60 times lower than that of conventional dry cow preparations, the economic benefits, coupled to the high efficacy of this approach, supercedes that of the traditional dry cow treatment.

References

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Paper presented at the XIIIth World Congress on Cattle Diseases, Durban, S. Africa, Sept. 17-21, 1984.

XIIIth WAB Congress

Selected papers and summaries presented at the XIIIth World Congress on Cattle Disease which was held in Durban, South Africa are published in this issue, since The Bovine Practitioner is also the official communication link between the member Buiatrics Associations.

Copies of the full proceedings of the Durban Congress may be purchased from the South Africa VMA, P. O. Box 25033, Monument Park, 0105, Pretoria, South Africa for R40 (approx. $20) per set, plus mail.

CONVENTION TOUR

Veterinarians attending the International Congress were taken in small groups to visit farms and practices in the area. Several participated in tours to Zululand, Swaziland, and across to Johannesburg. Here they visited a gold mine and drove to the Onderespoort Veterinary School near Pretoria and veterinary clinics in the area.

A visit to Cosmore Farm, owned by Mr. D. V. Horton in Natal. He farms over 1000 acres with beef and dairy units. Left to right: Dr. Ed Sterner, Dr. Harold Amstutz, Mrs. Sterner, Dr. Irv Collinge, Dr. Robert Harris, and their host, Dr. R. Peterson, Petermaritsburg, the local veterinarian, and Mr. Horton.