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Group L beta-haemolytic streptococcal infection in meat handlers: another streptococcal zoonosis?

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SUMMARY

Group L, β-haemolytic streptococci can cause infection in dogs, pigs, cattle and sheep but there have been very few reports in man. In studies of skin infection in meat handlers we cultured group L streptococci from clinically infected wounds, impetigo and paronychia of 15 patients involved in the slaughter and processing of chickens and pigs. *Staphylococcus aureus* was also present in eight (53%) of the lesions. At least five other infections with group L streptococci in meat and animal handlers are known to have occurred in other parts of England in recent years, and brief details are given.

INTRODUCTION

Beta-haemolytic, Lancefield group L streptococci (βGLS) have been found in healthy carriage or infection in many animals, including poultry (Barnham, Kerby & Skillin, 1982), pigs (Olsen, 1957; Olsen, 1964; Jones, 1976*a*, *b*, 1981), cattle (Olsen, 1957; Klastrup, 1963; Jensen *et al.* 1958; Wilson & Salt, 1978), sheep (Thal & Moberg, 1953), dogs (Stableforth & Galloway, 1959; Laughton, 1948) and other small fur-bearing animals (Thal & Moberg, 1953). They have been occasionally found in the human throat (Olsen, 1957; White, Rudd & Ward, 1939; Nordlander, Thal & Tunevall, 1975), but infection in man appears to be rare: there are reports of septicaemia and endocarditis (Bevanger & Stamnes, 1979; Ellner, 1970), skin infection (David & Cambridge, 1986) and abscess in the hand of a butcher (Duma *et al.* 1969).

In our recent surveys of skin infection in meat handlers in North Yorkshire and Scotland (Barnham & Kerby, 1984; Neilson *et al.* 1986) we found several patients infected with βGLS. In the pig and chicken slaughter/processing factories where these patients were seen there was intermittent environmental contamination with βGLS, thought to originate from the animals (Barnham, Kerby & Skillin, 1982; Barnham & Kerby, 1981). In this paper we summarize the relevant findings in our surveys, give details of the patients and a general discussion of group L streptococcal infection in man.

PATIENTS AND METHODS

In the Harrogate and Northallerton districts of North Yorkshire we have had a special interest in the skin infections of meat handlers since 1978; infections became known to us from the details given on routine microbiology request forms and from information given by general practitioners, staff of Accident and Emergency departments and Environmental Health Officers. Whenever an episode was recognized inquiries were made, which often revealed outbreaks of infection. We took swabs only from clinically infected wounds of these workers, none from clean, healing wounds or intact skin. Results of investigations from June 1978 to December 1986 are included here.

Details of bacteriological methods in the Harrogate and Northallerton laboratories were given in an earlier report (Barnham & Kerby, 1984); antibiotic susceptibility tests were performed by disk diffusion using the following disk contents: penicillin 2 units, tetracycline 10 μg and erythromycin 5 μg. All β-haemolytic streptococci of groups other than A, B, C, D, F and G were sent to the Streptococcus Reference Unit, Central Public Health Laboratory, Colindale for identification.

In Scotland a survey of 11 abattoirs was undertaken between October 1983 and February 1984, with further monitoring at three of them until March 1985. The hands and forearms of meat handlers were examined and swabs were taken only from lesions which appeared to be clinically infected. Details of this work have been recorded elsewhere (Neilson *et al.* 1986). Bacteriological methods similar to those employed in North Yorkshire were carried out in the Departments of Bacteriology at Stirling Royal Infirmary, Perth Royal Infirmary, Crosshouse Hospital, Kilmarnock and Ruchill Hospital, Glasgow. Group L streptococci were identified in the laboratory at Ruchill Hospital.

Limited environmental sampling for β-haemolytic streptococci was carried out in two chicken and two pork slaughter/processing factories as described in earlier reports (Barnham, Kerby & Skillin, 1982; Barnham & Kerby, 1981).

RESULTS

Findings in the patients

In the North Yorkshire survey 604 episodes of skin infection were found including 54 sporadic infections and 22 outbreaks; 269 of those tested bacteriologically yielded β-haemolytic streptococci. As shown in Table 1, βGLS were identified from 6 of 198 infections in poultry-meat handlers, and 7 of 71 in red-meat handlers. In Scotland 2 of 62 infections yielding β-haemolytic streptococci showed βGLS. Overall, βGLS accounted for 15 of 331 (4·5%) streptococcal isolates from infected wounds of meat handlers. *Streptococcus pyogenes* (group A) was much the commonest isolate, but βGLS was the next most commonly found, followed by organisms of groups G, B and C.

Details of the patients yielding βGLS are given in Table 2. Six women and nine men between the ages of 16 and 57 years were affected: six engaged in chicken and nine in pork handling. Patients 1–5 were found during the investigation of an outbreak of *Strep. pyogenes* infection in a chicken-processing factory and patient

Table 1. *Beta-haemolytic streptococci found in surveys of skin infection in meat handlers*

Survey	Total of groups	Number of infections yielding β-haemolytic streptococci of Lancefield group						
		A	B	C	E	G	L	No detectable group
North Yorkshire*, handlers of poultry meat	198	180	4	1	—	6	6 (3·0)	1
red meat	71	62	—	—	1	1	7 (10)	—
Scotland†, handlers of red meat	62	45	5	4	—	6	2 (3·2)	—
Total: North Yorkshire and Scotland	331	287 (87)	9 (2·7)	5 (1·5)	1 (0·3)	13 (3·9)	15 (4·5)	1 (0·3)

* Surveys June 1978 to December 1986; † survey October 1983 to March 1985. Figures in parentheses are percentages of total infections in that survey.

Table 2. *Details of patients yielding group L streptococci from infected lesions of the hanc*

ıtient no.	Sex, age (years)	Date of infection	Meat handled	Nature of work	Nature of infection	Other organisms present
1	F 20	Oct 83	Chicken	Packing	Wound infection	No (*Strep. pyogenes* in a separate wound)
2	F 32	Oct. 83	Chicken	Evisceration	Wound infection	*Staph. aureus*
3	F 17	Oct. 83	Chicken	Packing	Wound infection	*Staph. aureus*
4	M 24	Oct. 83	Chicken	Killing	Paronychia	*Staph. aureus*
5	F 16	Oct. 83	Chicken	Giblet packing	Wound infection	*Staph. aureus*
6	F 55	May 84	Chicken	Packing	Impetigo	*Staph. aureus*
7	M 45	Dec. 80	Pork	Boning	Wound infection	*Staph. aureus*
8	M 27	Jan. 81	Pork	Boning	Paronychia	No (*Staph. aureus* in a separate wound)
9	M 26	Oct. 83	Pork	Cutting	Wound infection	No
10	M 38	Oct. 83	Pork	Cutting	Wound infection	No
11	F 34	Oct. 83	Pork	Handling and loading	Wound infection	No
12	M 28	Oct. 83	Pork	Bacon preparation	Wound infection	*Staph. aureus*
13	M 24	Sep. 86	Pork	Cutting	Wound infection	No
14	M 27	Jan. 84	Pork	Killing	Wound infection	No
15	M 57	Jan. 84	Pork	killing	Wound infection	*Staph. aureus*

6 presented with a sporadic infection from the same factory the following May, the only case we found outside the autumn and winter months. Patients 7–15 were detected during outbreak investigations and surveillance in three separate pig slaughter/processing factories. In addition to βGLS, *Staphylococcus aureus* was present in eight (53%) of the lesions.

Infection with βGLS could not be distinguished on clinical grounds from that caused by *Strep. pyogenes*. Wounds often showed erythema, induration and delay in healing, and some showed gaping and loss of tissue. Acute paronychia was seen in two patients and a weeping impetiginous rash between the fingers in one, but we saw no ascending lymphangitis or abscess formation. Patients in our surveys were treated with oral flucloxacillin, penicillin or erythromycin with generally satisfactory results, but we made no special study of the outcome in those infected with βGLS.

Environmental findings

Limited sampling in the pork factory where patients 7 and 8 became infected showed βGLS in pig bloodstains and on handles and taps.

Investigations in two chicken factories in North Yorkshire showed widespread intermittent environmental contamination with βGLS (Barnham, Kerby & Skillin, 1982). They were found in every month of the year, particularly on the chicken carcases and surfaces directly contaminated from them, on handles and on doors. This followed supply of chickens from many different farms. Beta-haemolytic streptococci, mostly group L, were found in two thirds of 115 chicken heads we examined.

Laboratory aspects

After 18 h aerobic or anaerobic incubation on Petri dishes containing 6% horse blood agar the organisms grew in colonies up to 1–1·5 mm diameter surrounded by wide zones of β-haemolysis. Touched with a wire the colonies would spread like butter rather than break.

Most strains gave a zone of inhibition when tested with a bacitracin identification disk (content 0·1 unit) and many gave false-positive cross-reactions with group A reagent in slide coagglutination Lancefield grouping tests (Pharmacia: Phadebact Streptococcus Test) (Barnham, Kerby & Skillin, 1982). There were, however, no false reactions when the organisms were grouped by the standard Lancefield's precipitation method in the reference laboratories.

In antibiotic disk susceptibility tests all our isolates were susceptible to penicillin and erythromycin, but 12 of the 15 (80%) isolates from patients and most of the environmental isolates were resistant to tetracycline.

Isolates from patient 6 (chicken-associated) and patient 13 (pork-associated) were tested with the API 20STREP test (API Laboratory Products Ltd, Basingstoke): both strains failed to hydrolyse sodium hippurate or to ferment lactose, and they both gave the profile 0463017. The isolate from patient 13 will be preserved in the National Collection of Type Cultures, Colindale as NCTC 12081; unfortunately, the organisms from other patients were not saved for further investigation and comparison.

Further cases known to the Public Health Laboratory Service

In the winter of 1981–2 five further human infections with βGLS were reported to the Communicable Disease Surveillance Centre, Central Public Health Laboratory, Colindale from southern counties of England (CDSC, unpublished). These include a 42-year-old man who helped on a pig farm and had an infected ulcer on the foot, two butchers aged 17 and 22 years with cuts that were slow to heal, a slaughterman aged 22 years with an infected cut on the wrist and an abattoir worker with an infection on the hand. The last two patients had known occupational exposure to pigs. *Staph. aureus* was also present in the wounds of four of these patients.

DISCUSSION

Fry (unpublished, see Wilson, Miles & Parker, 1983) first described group L streptococci from dogs and pigs. No specific names have yet been given to streptococci in this group. The group antigen is carried by a variety of streptococci, only some of which are β-haemolytic. In her original study of isolates from pigs McLean (1955) found both α- and β-haemolytic strains, the former showing greater biochemical activities. She also noted a minute-colony β-haemolytic form, but insufficient tests were done to show if this was *Strep. milleri* carrying the group L antigen, as may be found bearing the appropriate antigens in Lancefield's groups A, C, F and G (Leading article, 1985).

In a study of human oral α-haemolytic streptococci (Bratthall & Carlsson, 1968) two strains of *Strep. mitis* were shown to react with group L antisera. Alpha-haemolytic group L streptococci (αGLS) have been isolated from the discharge of

a patient with acute parotitis (Duma *et al.* 1969) and from the blood cultures of a number of patients, including two with endocarditis, although in many other cases they were thought not to be clinically significant (Duma *et al.* 1969; Broome, Moellering & Watson, 1976). The species of infecting organisms were not determined in these reports, but it seems likely that they were human oral viridans-type streptococci.

In reviewing the reports of human infection it is useful to distinguish between those yielding αGLS and βGLS. However, this distinction may not always be correct, and we urge that in future biochemical and physiological tests should be used to characterize isolates and to establish which species of viridans streptococci can carry the group antigen.

Beta-haemolytic group L streptococci may be harmlessly carried in the respiratory and genital tracts of pigs and dogs but they may also cause septicaemia (Laughton, 1948) and, in the pig, septic arthritis, meningitis and endocarditis (Jones, 1976*a*; Wilson & Salt, 1978; Stableforth & Galloway, 1959). When pigs were experimentally injected with βGLS, 50% developed endocarditis and septic polyarthitis within 14 days (Jones, 1981). Bovine mastitis with βGLS has occurred more commonly in Denmark than elsewhere (Klastrup, 1963; Wilson & Salt, 1978); this is thought to be due to cross-contamination in the common husbandry of both pigs and cows on farms there. The organisms have been found in a variety of infections in sheep and fur-bearing animals (Thal & Moberg, 1953) and are commonly present in the nasopharynx of healthy chickens (Barnham, Kerby & Skillin, 1982).

In man there have been very few reports of infection with βGLS, but those there are show that it can be the cause of serious infection. Ellner (1970) reported a 43-year-old alcoholic man who suffered bacterial endocarditis complicated by multiple cerebral embolism; the source of infection was unknown. Another, uncomplicated case of endocarditis was recorded by Bevanger & Stamnes (1979) in a 42-year-old man who denied contact with animals. These authors also reported a 56-year-old woman who developed septicaemia after an attack of thrombophlebitis in the leg (Bevanger & Stamnes, 1979); the patient was often in contact with dogs.

βGLS were first found in the human throat by White, Rudd & Ward (1939) in a study of patients with scarlet fever in Australia (strains 'Hooper' and 'Krone': see Wilson & Miles, 1946), and have since been found at this site in patients both with (Nordlander, Thal & Tunevall, 1975) and without (Olsen, 1957) signs of respiratory infection. They have been found on the normal skin of pig farmers (Olsen, 1957) and, together with *Staph. aureus*, in infected eczema on the face, scalp and ear of an 8-month-old child (David & Cambridge, 1986); the family in this last case kept a pet rabbit and the mother had just bought large quantities of beef and pork at a meat market when the infection arose (Dr T. J. David, personal communication). Duma *et al.* (1969) reported a 38-year-old butcher who handled pork and developed an abscess in the hand following a cut; incision of the lesion liberated 3 ml of pus which yielded a pure growth of βGLS.

We isolated βGLS from clinically infected wounds, paronychia and impetigo on the hands of 15 meat handlers. The organisms were found in a similar proportion of infected wounds in both red meat and poultry meat handlers and, after *Strep.*

pyogenes, they were the most commonly found β-haemolytic streptococci in the wounds. Infection resembled that caused by *Strep. pyogenes* (Barnham & Kerby, 1984; PHLS Working Party, 1982) in clinical features, admixture with *Staph. aureus* in about half the wounds and the main occurrence in the autumn and winter months. We think that they were significant as a cause of infection in at least some of our patients; the published case reports show the ability of βGLS to cause infection in man, and in half our cases they were isolated in pure growth from clearly infected lesions.

Strep. pyogenes infection in meat handlers is thought to originate from human sources (Barnham & Kerby, 1984; PHLS Working Party, 1982) but βGLS most probably come from animals. Workers are likely to acquire βGLS directly from animal carcases or from environmental surfaces at work, which we found to be intermittently contaminated with the organisms. There is a need for further study of skin and wound contamination with these organisms to determine how often they lead to clinical infection.

The occurrence of βGLS in human infection may have been underestimated for certain technical reasons. Firstly, few diagnostic laboratories identify the Lancefield group of isolated β-haemolytic streptococci beyond the groups A–G, and group L will therefore not be specifically recognized. Secondly, the sensitivity of many strains to bacitracin, and the false reactions in coagglutination and fluorescent Lancefield grouping tests noted by us and other workers (Barnham, Kerby & Skillin, 1982; Bevanger & Stamnes, 1979; Ellner, 1970; Duma *et al.* 1969) may lead to isolates being wrongly identified as *Strep. pyogenes*.

All but one of the infections described here came to light in special studies of meat handlers. Human infection with βGLS might also occur in other settings. Those involved in the breeding and rearing of pigs and chickens may be exposed and have sometimes been found to carry the organisms (Olsen, 1957); one of the patients in the present report worked on a pig farm. Other possible epidemiological settings include contact with dogs (Bevanger & Stamnes, 1979) and consumption of raw milk from cattle with group L streptococcal mastitis. A search for sources such as these would be of interest when there is human infection with βGLS.

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