



# A prolonged outbreak of streptococcal infection among workers at a meat plant

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We describe an outbreak of skin sepsis due to an erythromycin-resistant strain of *Streptococcus pyogenes* in workers at a meat plant. The outbreak began among butchers in the boning room but subsequently spread to other groups of workers in the plant. Despite the introduction of additional control measures, the outbreak persisted for 7 months and affected 46/194 staff with 'hands on' occupations. Spread of infection from the plant to a retail butcher was documented.

**Key words:** *Streptococcus pyogenes*, meat handling, meat plant, retail butchers, occupational health.

## Introduction

By the nature of their work, meat handlers are potentially exposed to various zoonotic infections including Q fever, psittacosis, bovine tuberculosis and erysipeloid. In the last twenty years, the importance of skin sepsis due to haemolytic streptococci has been increasingly recognized in this group of workers.<sup>1,2</sup>

Streptococcal infections may occur sporadically but, in addition, outbreaks affecting individual plants have been reported.<sup>3-5</sup> We describe such an outbreak which by its scale and duration, despite attempts at control, raised substantial public health concerns and questions.

### The outbreak

Towards the end of September 1991, staff in the local Microbiology Department received swabs from several patients with skin infections from which erythromycin-resistant Group A streptococci were isolated. The clinical information provided by GPs indicated that the cases worked in a local meat factory and enquiries with the occupational nurse at the factory revealed that there had been an unusual number of skin infections beginning in August 1991.

## Methods

Because of the potential implications of the outbreak the consultant for Communicable Disease Control and Consultant Microbiologist arranged to visit the factory and undertake an investigation.

Detailed environmental investigations were undertaken to establish practices within the plant and to try to identify deficiencies which might have accounted for the outbreak.

Arrangements were made for regular hand inspections of staff to be performed and swabs taken from suspected septic lesions; swabs were processed using standard methods. *Staphylococcus aureus* and Group A haemolytic streptococci were tested for antibiotic sensitivity using Stoke's method and were typed using estab-

lished methods. Group A typing was performed by the Oxford Public Health Laboratory and the Laboratory of Hospital Infection of the Central Public Health Laboratory.

Nose and throat swabs were obtained from confirmed cases of streptococcal sepsis and repeat swabs from skin lesions were obtained after completion of antibiotic therapy.

Epidemiological investigations included the construction of an epidemic curve and characterisation of cases by place and person. The statistical significance of possible risk factors was assessed using the Chi-square test.

## Results of environmental investigations

### The factory

The factory was a large plant, covering an area of several acres, built in the 1970s and situated in a rural area. The factory functioned both as an abattoir and also as a boning and packing plant, processing beef, pork and lamb but not poultry. It employed 264 staff. Meat inspectors from the local Environmental Health Department worked in the plant regularly. It also had a resident veterinary surgeon. The plant operated five days a week from 07.00 to 17.00 and, if necessary, on Saturday mornings.

The plant was divided into three main areas. In the first, animals were slaughtered, skinned, eviscerated, decapitated and the carcass then bisected. Animals were normally slaughtered within 12 h of arrival. The staff of the abattoir section were completely separate and had separate changing rooms to other staff.

Bisected carcasses then proceeded to the hanging room where they were refrigerated to +2°C or less. From the hanging room, the carcasses were conveyed to the boning room. Animal carcasses were normally boned within 48 h of slaughter and jointed meat was despatched within 7 days of slaughter.

### Boning room

At the time of the initial investigation, cases appeared to be confined to the boning room so this area was investigated in greater detail. It functioned in two areas: in the

**Table I** Anatomical sites of group a streptococcal infection

Finger	13
Hand	9
Arm	5
Thumb	3
Wrist	3
Elsewhere	6
Total patients	32

N.B. Some patients had more than one site positive.

first area, butchers boned meat and butchered it to manageable size. Work was done on production lines for beef, lamb and pork. In the second area, boned meat was packaged ready for export or sale to retail butchers or for transfer to another plant for processing for ready-packed supermarket sales. The boning room was air-conditioned to ensure that the meat temperature did not exceed 7°C during boning and packing.

#### Cleaning

(1) *Equipment.* Each butcher had his own set of knives and a steel. Each work station had a heated trough (84°C) for pasteurising knives during work. At the end of the day, knives and steels were cleaned with hot water and detergent and then stored dry.

(2) *Environment.* The inspection of the plant revealed a high standard of cleanliness. There was a comprehensive programme of cleaning and disinfection. All changing rooms were cleaned fully at the start of each day; this included floor, wall, doors, etc. which were washed or mopped down.

At the end of the working day, ancillaries cleaned the boning room. This involved brushing up and removing all gross debris, spare packaging, etc. After they had finished and all meat had been removed, evening cleaners came in and rinsed all walls, floors and equipment with pressurized hot water hoses. The whole area was then foamed with an alkaline detergent foam. This was rinsed off and then the area was sprayed with a quaternary ammonium compound.

#### Personnel

The boning operation is performed by butchers who undertake a 12–18 month training. The average age of staff was under 30. Seventy per cent of staff smoked and a very high proportion bit their nails. Staff turnover was low. Basic pay was supplemented by bonus payments and although the loss of earnings in the event of sickness was minimised, it was still significant.

Butchers wore white overalls covered by a long plastic apron. A chain mail apron was worn over this. The hand used to hold meat was protected by a chain mail glove; each employee had his own plastic apron and chain mail gloves and apron.

Hand washing was performed in a surgical scrub-type sink with knee operated taps. Liquid soap was provided from push bottle dispensers. Nail brushes for removing

fat, etc. from under nails were used communally and resided in the sink trough.

At the end of the day, protective clothes were washed with high pressure hot water hoses and detergent and were then hung up to dry. The staff were then issued with a clean set of overalls which they stored in their locker for use the following day.

Male and female changing rooms, quite separate from those for abattoir staff, were provided for butchers and packers. Each member of staff had a locker. The changing rooms also had toilets, hand wash basins and showers. Staff were required to change out of work clothes for meal breaks.

#### First aid and occupational health

The factory employed a full time occupational nurse. She saw staff pre-employment and gave instruction on hygiene. She also provided a first aid service; cuts and grazes being cleaned and covered with blue elastoplast.

#### Microbiology

Between August 1991 and January 1992, 46 clinical infections were documented. Microbiological results were obtained from 38 of these. 32 (84%) grew Group A streptococci. 16 (41%) grew *S. aureus*, two produced negative results. All Group A streptococci were erythromycin resistant and typed as T: Imp 19, M: 25, OF +ve. A range of phage types of *S. aureus* was obtained. The sites from which Group A streptococci were isolated are shown in Table I.

#### Epidemiology

The epidemic curve is shown in Figure 1. This shows a slow onset with a marked peak in the second half of September 1991. Control measures were introduced on 30 September 1991 as indicated by the arrow.

Following this, the number of new cases declined and, indeed, over a five week period from late October to November, there was only one new case and it seemed the outbreak had terminated.

However, there was a second wave of cases in December 1991 which caused considerable anxiety and the outbreak did not finally terminate until the beginning of February 1992 – seven months after it began.

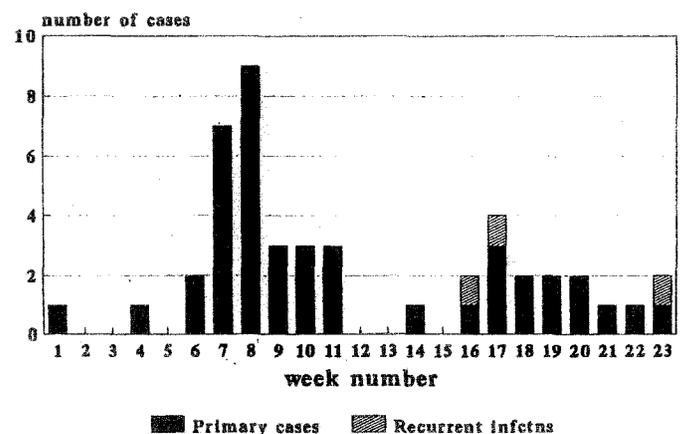


Figure 1 Total number of primary and of recurrent cases of streptococcal infection during the 23 weeks

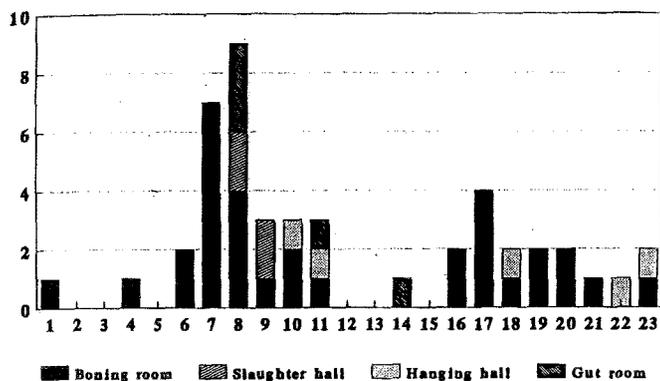


Figure 2 Numbers of staff with streptococcal infections (by location within the plant)

The distribution of cases within the plant is shown in Figure 2. It is clear from this that the outbreak began in the boning room and spread to other areas subsequently. The distribution of cases by occupation is shown in Table II. This shows that the attack rate was significantly higher in workers in the boning room and hanging room and significantly lower in clerical/managerial staff and slaughter hall workers.

Figure 3 shows that within the boning room the butchers accounted for 16/19 cases in the first part of the outbreak whereas in the second part of the outbreak 7/13 cases in this area were packers.

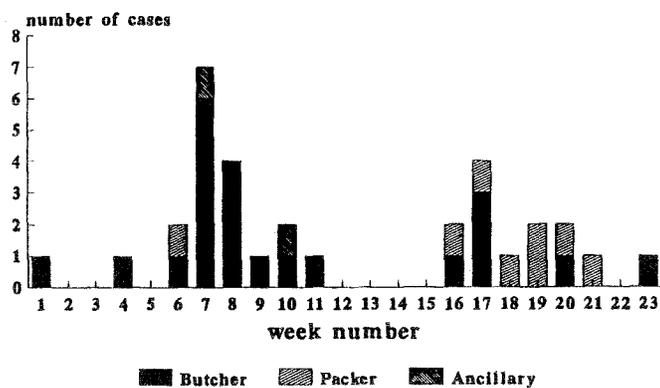


Figure 3 Numbers of cases of streptococcal infection by occupation within the boning room

### Relapse/re-infection

Six members of staff had either relapse or recurrent infection. In two cases this was probably due to inappropriate therapy with erythromycin; in four cases, apparently adequate therapy was given and clinical/microbiological infection occurred several weeks after resolution of the first episode. Re-infection seems much more likely than relapse.

### Spread outside the plant

During the flare up of infection in December an erythromycin-resistant Group A streptococcus was isolated from a skin lesion of a local retail butcher. This strain proved to be of the same type as the outbreak strain. Enquiries revealed that the butcher's shop regularly received deliveries of meat from the plant where the outbreak was in progress.

### Discussion

Outbreaks of skin sepsis due to haemolytic streptococci have been reported in meat workers, both in the UK and elsewhere.<sup>3,4</sup> There is no evidence that carcasses or meat are the primary source and, in some outbreaks, there have been data to indicate that infection was introduced by a member of staff with an impetiginous lesion<sup>5</sup> as probably happened in the currently reported outbreak.

The occurrence of the outbreak in Autumn is typical and probably reflected the seasonal increase in slaughter and meat handling at that time of year.

The strains of Group A streptococcus associated with outbreaks in meat workers tend to be of unusual serotypes<sup>1</sup> as was the case in our outbreak. We believe that this is the first reported outbreak in meat workers to involve an erythromycin-resistant strain. This probably contributed to the outbreak becoming established, since initially a number of cases were treated unsuccessfully with this antibiotic.

One of the major factors predisposing meat workers to skin sepsis is minor trauma to the hands. Many of the workers in the plant bite their nails as has previously been reported. Barnham *et al.* reported that up to 59% of workers have cuts or lacerations to their hands.<sup>2</sup> That other factors must operate was suggested in a study which compared traumatic lesions, skin

Table II Number and percentage of staff infected (by occupational category)

Staff group	Total	Number infected	Attack rate (%)	$\chi^2$	Significance P
Clerical management, etc.	70	0	0	20.1	0.000007
Slaughter hall workers	50	4	8	4.7	0.03
Boning room:					
Packers	40	8	20		
Ancillary	10	2	20		
Boners	70	22	31		
All boning staff	120	32	27	13.06	0.0003
Gut + bi-products	16	5	31	2.26	NS
Hanging hall	8	5	62.5	11.6	0.0006
Total	264	46	17.4		

sepsis and streptococcal infection in different occupational groups.<sup>6</sup> This revealed that meat handlers and engineering workers had similar levels of trauma but skin sepsis was much more prevalent in meat workers (12% vs. 1%). It has been suggested that implantation of bone dust and fragments in wounds may act as a nidus in which an infection may be established.<sup>2</sup> There is also evidence that infection may be transmitted by passively contaminated meat. Streptococci survive well on meat and the outbreak strain was isolated from meat in one outbreak.<sup>5</sup>

Increased attack rates among selected groups within a plant have been previously described. The current outbreak clearly began among butchers in the boning room and spread to other workers in this room and to other parts of the plant. The spread to slaughtermen and gutroom workers was surprising in view of the fact that meat did not return from the boning room to these areas and the staff had separate changing facilities to the boning room staff. We were unable to establish a satisfactory explanation for this.

Approximately ten years ago, a PHLS working party produced advice on reducing streptococcal infection in meat workers.<sup>7</sup> All of the recommendations were implemented in the plant prior to the current outbreak, apart from the fact that there was not a designated medical officer. The control measures that were available were, therefore, limited. Barnham<sup>4</sup> recommended rapid recognition of infection and antibiotic treatment of patients, on clinical suspicion, once swabs had been taken. Although exclusion of infected staff was not considered essential, it was decided in the current outbreak to implement this along with the other measures described.

The factory co-operated with the recommendations and initially the policy seemed to be successful. The second wave included packing staff who had been largely unaffected in the early part of the outbreak. It also arose in the pre-Christmas period when the plant was at its busiest. This, together with the evidence of spread to a retail butcher, caused considerable anxiety as to whether there was a risk to public health. Decisions as to how to deal with the outbreak were made against a background of conflicting concerns. The factory is a major local employer and any publicity about the outbreak could have resulted in a loss of major contracts and consequent severe financial damage. On the other hand, transmission to a member of the public might have led to a severe – even fatal – infection.

Consideration was given to extending investigations to include swabbing all members of staff. However, past experience suggested that screening of staff for respiratory carriage is not worthwhile.<sup>4</sup> This was reinforced by the fact that none of the nose and throat swabs obtained from cases yielded the outbreak strain.

Similarly although environmental swabs have yielded Group A streptococci, the information is of little value if an appropriate cleaning schedule is in progress. It was considered that the risk to the public was very low in this outbreak. Therefore, the decision was taken to reinforce the steps introduced initially but not to extend to other measures. Following this, the outbreak smouldered at a low level for a further six weeks before terminating seven months after it had begun.

#### Acknowledgements

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