Infection with *Streptococcus agalactiae* in a London hospital

**F. S. MHALU**

*From the Department of Bacteriology, Royal Postgraduate Medical School, Hammersmith Hospital, London W12*

**SYNOPSIS**  *Streptococcus agalactiae* is presently the commonest β-haemolytic streptococcus isolated from clinical material in this hospital. Between October 1974 and March 1975, 81 patients with such infections were seen. Seventeen had urinary tract infections, six had septicemia, and one neonate had meningitis. Three of those with septicemia were neonates and two died. The organism was also found to be a cause of pyogenic skin conditions in five patients. Isolates from throat swabs in 12 patients, from sputum in four, and from the female genital tract in 18 were considered part of the normal flora. Human strains of *Str. agalactiae* were found to be biochemically different from animal strains.

*Streptococcus agalactiae* (β-haemolytic streptococcus Lancefield group B) is classically known as a cause of mastitis in cattle. Only after the development by Lancefield (1933) of her method for grouping streptococci was human colonization and infection by this organism recognized. Although not yet universally accepted, workers in the United States of America and the Netherlands recognize that the varieties of *Str. agalactiae* found in man are biochemically, physiologically, and serologically different from those causing bovine mastitis (El Ghoroury, 1950; Brown, 1953; Butter and De Moor, 1967). Human infection, unless due to direct exposure to infected animals or their products, is acquired from other human sources. However, cross infection between man, except in cases of neonates acquiring the organism in passage through the birth canal, has not been demonstrated, and most cases arise from autoinfection.

As a result of observing that *Str. agalactiae* was currently the commonest β-haemolytic streptococcus isolated from clinical material in this hospital, a prospective study was undertaken to establish the type of patients involved. It was also decided to test whether the strains isolated from patients in the United Kingdom conformed to the biochemical criteria characteristic of *Str. agalactiae* from human material as described in other countries.

**Material and Methods**

In the six months from October 1974 to March 1975 a record was kept of all specimens from which Lancefield group B streptococcus was isolated. All such strains isolated during the period were kept for biochemical and antibiotic sensitivity tests. Thirteen strains of *Str. agalactiae* of animal origin, kindly made available by Weybridge Central Veterinary Laboratories, were studied in parallel with the human strains for comparison. The following tests were carried out on all the strains:

**LACTOSE AND SALICIN FERMENTATION** 1% peptone water sugars with Andrade’s indicator were inoculated with each of the strains and incubated for up to seven days.

**HIPPURATE HYDROLYSIS**  The method of Hare and Colebrook (1934) was used.

**CAMP TEST** (Munch-Petersen and Christie, 1947) 4% sheep blood agar plates were inoculated in a line along the middle with a β-haemolysin producing strain of *Staphylococcus aureus*. Up to 10 strains per plate of the *Str. agalactiae* were each streaked in a line on either side and at right angles to the *Staph. aureus*; a gap of about 2 mm was left between the medial ends of the streptococcus streaks and the staphylococcal inoculum. Plates were then incubated aerobically overnight and inspected for the presence of ‘arrowheads’ of complete haemolysis, as shown in the figure. Such haemolysis did not occur when the plates were incubated anaerobically.

**PIGMENT PRODUCTION**  Strains were streaked on plates of Columbia agar
producing Staph. and the 0, employing the ditch strain using 4 (3) were incubated overnight using (Oxoid), as a plate Sensitivity tests SENSITIVITY ANTIBIOTIC control. Str. haemolysis; OF ASSESSMENT blood Stokes, were done with bacitracin. This was considered significant. Although the streptococcus was commonly isolated from patients with sore throats, no significance could be laid on the isolates because so far no conclusive proof has been produced to incriminate Str. agalactiae in the causation of sore throat.

Six patients had Str. agalactiae isolated from blood cultures. Three were adults and the others were neonates. The three adults with septicaemia included one man with endocarditis and one woman with puerperal pyrexia. The third was a woman with septicaemia complicating carcinoma of the breast with widespread metastases. Two of the three neonates with septicemia died. In another neonate the organism was isolated from cerebrospinal fluid. She also died in spite of chemotherapy.

No significance was attached to group B strepto-

<table>
<thead>
<tr>
<th>Type of Specimen</th>
<th>Sex</th>
<th>Significance of Isolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu (wound, abscess,</td>
<td>Male</td>
<td>8</td>
</tr>
<tr>
<td>and joint fluid)</td>
<td>Female</td>
<td>nil</td>
</tr>
<tr>
<td>Sputum</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Throat swab</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Blood</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Cerebrospinal fluid</td>
<td>1</td>
<td>nil</td>
</tr>
<tr>
<td>Vaginal swab</td>
<td>nil</td>
<td>18</td>
</tr>
<tr>
<td>Urine</td>
<td>nil</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>59</td>
</tr>
</tbody>
</table>

Table I Type of patient specimen from which Str. agalactiae was isolated
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coccus isolation from the female genital tract except that such isolates were thought to indicate the source of infection of the babies. Seventeen patients, all adult females and mostly with abnormal urinary tracts, were found to have urinary tract infection due to Str. agalactiae.

All the 99 human and all the 13 animal strains of Str. agalactiae were sensitive to penicillin and the animal strains were also sensitive to tetracycline. However, only 38% of the human strains were sensitive to tetracycline. One per cent of the human strains and 61% (8 out of 13) of the animal strains were sensitive to bacitracin.

Results of the biochemical tests on the 99 human and 13 animal strains are shown in table II. The biotypes of Str. agalactiae based on source, and biochemical and haemolytic properties proposed by Brown (1953) and reviewed by Butter and De Moor (1967) are:

Human Str. agalactiae
- var. opportunus, haemolytic, lactose negative, salicin positive
- var. mastitidis, haemolytic, lactose positive, salicin positive.

Bovine Str. agalactiae
- var. mastitidis, haemolytic, lactose positive, salicin positive
- var. asalignus, haemolytic, lactose positive, salicin negative
- var. agalactiae, non-haemolytic, lactose positive, salicin positive.

<table>
<thead>
<tr>
<th>Biochemical Test</th>
<th>Positive Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Human strains</td>
</tr>
<tr>
<td>Hippurate hydrolysis</td>
<td>99</td>
</tr>
<tr>
<td>CAMP test</td>
<td>99</td>
</tr>
<tr>
<td>β-haemolysis (small zone)</td>
<td>97</td>
</tr>
<tr>
<td>α-haemolysis</td>
<td>1</td>
</tr>
<tr>
<td>Non-haemolytic</td>
<td>1</td>
</tr>
<tr>
<td>Pigment production</td>
<td>93</td>
</tr>
<tr>
<td>Salicin fermented, lactose not fermented</td>
<td>81</td>
</tr>
<tr>
<td>Salicin and lactose fermented</td>
<td>12</td>
</tr>
<tr>
<td>Lactose fermented, salicin not fermented</td>
<td>nil</td>
</tr>
<tr>
<td>Salicin and lactose not fermented</td>
<td>6</td>
</tr>
<tr>
<td>Total number of strains</td>
<td>99</td>
</tr>
</tbody>
</table>

Table II Biochemical reactions of human and animal Str. agalactiae strains

Using the above biotyping scheme, 82% of the 99 human strains in this study were Str. agalactiae var. opportunus, 12% were var. mastitidis, and 6% could not be placed in this scheme because they did not ferment either salicin or lactose or they were non-haemolytic. Of the 13 animal strains studied, 10 (77%) were var. mastitidis, two were var. asalignus, and one could not be biotyped.

Discussion

In addition to being one of the common bacterial causes of bovine mastitis, Str. agalactiae is now recognized to be part of the normal bacterial flora in the human throat, genitourinary tract, and rectum. Butter and De Moor (1967) found that 10% of normal individuals harbour the streptococcus in the throat, while Baker and Barrett (1973) found up to 30% of normal adult females carried it in the vagina. Christensen et al. (1974) found Str. agalactiae to be the commonest streptococcus in the male urethra and the female lower genitourinary tract in patients under investigation for gonorrhoea. They concluded that Str. agalactiae in women is spread by sexual intercourse. During the past decade most interest in Str. agalactiae has centred on infections of the neonate; in some areas this has constituted the commonest cause of neonatal menigitis with a prevalence rate of 65% in 1972 (Yow, 1974). In this country an epidemiological study (British Medical Journal, 1973) recorded 14 cases of this condition from the whole of Britain in 1972. However, Reid (1975) found overall rates for neonatal morbidity and mortality of 2-7 and 1·0 per thousand live births respectively. The results of this study, which reports seven serious cases (septicaemia and meningitis) seen in a single hospital over a period of six months, indicate that infections by the organism are more frequent than was previously believed.

The female vagina is known to be the source of infections of the neonate and of auto-infection leading to puerperal pyrexia. Other sources of the organism must be considered in septicaemia and wound infections in the adult male. The throat is a likely source of such infections but this has not yet been shown to be the case. A possible source of septicaemia, especially in the adult female, is the urinary tract. In this study, urinary tract infection was found to be the commonest type of systemic infection with Str. agalactiae in the selected group of hospital patients studied.

Biochemical test results in this survey give support to the widely held view that human strains of Str. agalactiae differ from animal strains. Whereas the human strains fermented salicin but not lactose and uncommonly fermented both lactose and salicin, the animal strains mostly fermented both sugars and uncommonly fermented lactose but not salicin. Only one of the animal strains was found to give the opposite pattern. Six of the human strains did not ferment either salicin or lactose. Such strains have been recognized before by Butter and De Moor (1967) but have been neglected. It is time that such strains were recognized as a specific biotype. Ninety-three per cent of the human strains produced
pigment overnight; only 23% of the animal strains did so. Pigment production is therefore a potential differential test between animal and human strains. No significant difference in the haemolytic properties of the animal and human strains could be found in this study; whereas 97% of the human strains produced β-haemolysis on horse blood agar, 84% of the animal strains were also β-haemolytic. It can be inferred that *Str. agalactiae*, whether of human or animal origin, is more often haemolytic than not on horse blood agar.

Most of the human *Str. agalactiae* strains in this study were resistant to bacitracin while more than half of the animal strains were sensitive. Thus the test for sensitivity to bacitracin of β-haemolytic streptococci from throat swabs in man maintains its usefulness as a screening method for differentiating *Str. pyogenes* from the commonly found 'non-pathogenic' *Str. agalactiae*. Sixty-two per cent of the human strains were shown to be resistant to tetracycline. This indicates that, like *Str. pyogenes*, *Str. agalactiae* infections should not be treated with tetracyclines unless sensitivity results are available.

This work was done while I was holding a World Health Organization fellowship grant, but the statements made and the opinions expressed are not necessarily those of the WHO. I am grateful to Dr J. H. Darrell for encouragement and advice in carrying out the study and to the other medical and technical staff of the department for assistance. I am also grateful to Mr G. Salt of the Central Veterinary Laboratories, Weybridge, Surrey for providing the animal strains.

References


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F S Mhalu

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