maternal mortality rate. Our opinion is contrary to this; one must resist doing a caesarean section in the hope that termination of pregnancy and the avoidance of labour will make management easier and in some way improve the maternal outcome. Only 2 reported cases have been delivered by caesarean section. Both these patients died, from a complication of a tracheostomy. It was our plan to have much stricter criteria before resorting to caesarean section. Nelson and McLean, in a review of the syndrome, state that the condition is not affected by pregnancy or pregnancy termination. The progress of labour in the cases described was no different from that of many primiparous patients and there is no evidence to suggest that uterine function is altered. The patient required no analgesia and has no recollection of the labour or of any pain experienced. The patients described by Sudo and Weingold, and Rudolph et al., who required ventilatory support at the time of delivery also had apparently painless contractions.

Recently, plasmapheresis has been found to be of value in Guillain-Barré syndrome if performed within 7 days of the onset of symptoms and signs and in patients with severe disease. Plasmapheresis has been used in pregnant patients with rhesus haemolytic disease and should be considered in the acute situation and in severe cases in pregnancy. It was not attempted in our patient because she was first seen 3 weeks after the onset of symptoms and because she went into labour within 48 hours of mechanical ventilation after sudden rapid deterioration in her condition.

It is our opinion that the management of the gravid patient with Guillain-Barré syndrome does not differ much from that in non-pregnant patients with this disease. Supportive care in an intensive care unit remains the cornerstone of treatment. Management of airway and respiratory infection, maintaining fluid and electrolyte balance, nutritional support and effective rehabilitation are essential. Unnecessary obstetric intervention must be strongly resisted.

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Endocarditis caused by Lactobacillus casei subspecies rhamnosus
A case report
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Summary
A case of subacute endocarditis in a 66-year-old man with mitral incompetence is described. The causative agent was identified as Lactobacillus casei subspecies rhamnosus, which is a normal commensal in the mouth. Despite the ubiquitous presence of these mouth commensals, this type of endocarditis appears to be rare. It is emphasised that a Lactobacillus species should be considered in cases of clinically obvious endocarditis with 'negative' blood cultures, including 'negative' subcultures following a significant radioactive count in the Bactec system. Suitable media for subculture should be used and incubation for at least 48 hours is required.

Lactobacilli are members of the normal human flora, being found in the mouth, lower alimentary tract and vagina. They are also encountered in plant material and in animal products, and since ancient times have played a key role in the preservation of animal protein in the form of various yoghurts and cheeses.

As normal commensals, these organisms have generally been considered non-pathogens. In fact, certain Lactobacillus species

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Endocarditis caused by Lactobacillus casei subspecies rhamnosus
have been used in an attempt to counteract the overgrowth of pathogenic organisms in the alimentary tract. However, a few cases have been recorded in which lactobacilli have been responsible for serious infections such as meningitis, peritonitis, endometritis and endocarditis. The first documented case of Lactobacillus endocarditis in the USA was recorded by Axelrod et al. in 1973. These authors, who reviewed the world literature on infections caused by lactobacilli, found that 6 cases of endocarditis and 2 of meningitis had been recorded previously in other countries. A review of articles published subsequently has revealed a further 17 reported cases of Lactobacillus endocarditis, bringing the total to 24 documented cases.

We describe the clinical course of a case of endocarditis caused by L. casei subspecies rhamnosus. This is the first documented case of Lactobacillus endocarditis in South Africa.

Case report

A 66-year-old man was admitted to hospital in February 1985 with suspected infective endocarditis. In 1965 he had had an inferior myocardial infarction and in 1978 a grade 2/6 mitral pansystolic murmur had been noted. In November 1984 he underwent a bicuspid valve replacement surgery. On returning in February 1985 he was intermittently febrile, and on returning on 1 March blood cultures yielded a growth of Gram-positive bacilli. Since this isolate was initially thought to be a Listeria species the penicillin was replaced by intravenous ampicillin 2 g 6-hourly. This was increased to 3 g 6-hourly on 7 March because of continuing pyrexia and new embolic lesions on the soles of the patient's feet. On 8 March an echocardiogram showed gross mitral valve prolapse and a vegetation on the anterior leaflet which returned to normal by 12 March, at which stage the spleen was no longer palpable.

The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were 0.635 μg/ml and 20 μg/ml respectively for ampicillin indicating marked tolerance of this isolate. For netilmicin the MIC and MBC were both 0.15 μg/ml.

Microbiological investigations

Lactobacilli are slender, non-sporing Gram-positive bacilli which may occur singly or in chains. In some species corkscrew and tightly curled forms are encountered. They are non-motile, catalase-negative, and grow best under micro-aerophilic conditions, although some strains are strict anaerobes. They are a heterogeneous group of micro-organisms which produce acid by fermentation of glucose and grow best at a low pH (4.0-6.8).

Blood from the patient was cultured using the Bactec system, in which growth of micro-organisms is indicated by a rise in 14CO₂ count. A rise in radioactive count was noted in both aerobic and anaerobic bottles after 4 days' incubation. Smears stained by the Gram method revealed slender Gram-positive bacilli and some tightly curled forms. Subculture on to horse blood agar (incubated in the presence of 5% CO₂) and MacConkey agar produced a growth of small colonies after 24 hours' incubation with some greening of the blood agar medium. Preliminary biochemical tests showed that this isolate was catalase-negative and was able to hydrolyse aesculin and produce acid from glucose and lactose by fermentation, but was unable to hydrolyse arginine and did not produce acetoin from glucose (Voges-Proskauer test). It was non-motile both at room temperature and at 37°C, and electron microscopy revealed the absence of flagella. These data were sufficient to identify it as a Lactobacillus species, and gas-liquid chromatography and fermentation tests on a wide range of carbohydrates showed it to be L. casei ss. rhamnosus. Biochemical characteristics are summarised in Table 1.

| TABLE 1: BIOCHEMICAL CHARACTERISTICS OF L. CASEI SS. RHAMNOSUS |
|---------------------------------|-----------------|-----------------|
| Test                          | Result          | Test          |
| Catalase                      | Glucose         | Arginine      |
| Aesculin hydrolysis           | Glycogen        | dihydrolyrase  |
| Arginine                      | Inositol        | Voges-Proskauer |
| Tryptopholase                 | —               | test          |
| Urease                        | Lactose         | —             |
| Indole                        | Maltole         | —             |
| Nitrate reduction             | Mannitol        | —             |
| Gas-liquid chromatography     | Melezitose      | —             |
| (glucose)*                    | Melibiose       | —             |
| Motility                      | Ribose          | Raffinose     |
| Adonitil                      | Salicin         | Rhamnos        |
| Arabinose                     | Sorbitol        | —             |
| Cellobiose                    | Sucrose         | —             |
| Fructose                      | Trehalose       | —             |
| Galactose                     | —               | —             |

*Major lactic acid peak (>1.1 mmol/l) traces acetate and succinic acids. A = acid production.
Discussion

The commonest clinical syndrome resulting from systemic infection with *Lactobacillus* species appears to be infective endocarditis. This case shares several features with others described in published reports, such as predilection for left-sided cardiac involvement and subacute onset. An unusual case of right-sided cardiac involvement was reported by Tornos et al., who describe *L. casei* ss. *rhamnosus* endocarditis complicating tricuspid atresia in a 7-year-old girl who had undergone an operation to create a Waterston-type fistula at the age of 2 months, with good results.

In several of the documented cases, dental procedures such as extractions and scaling of teeth preceded the onset of symptoms. Comments about the presence of tooth decay are made in a number of reports. The source of lactobacillaeemia in most cases was obviously the oropharynx, which is supported by the frequency of the blood culture isolations of *L. casei* and *L. plantarum*, both of which are normal mouth commensals. It is surprising that in spite of the ubiquitous presence of these commensals, lactobacillaeemia in cases of endocarditis is relatively rare. There are several possible explanations. These organisms have fastidious cultural requirements, having a micro-aerophilic to anaerobic metabolism and a preference for a medium with a low pH, such as tomato juice or MRS agar. If these requirements are not met the organisms may not grow, or may require prolonged incubation. Tenenbaum and Warner found that blood cultures from their patient required as long as 16 days' incubation before growth of *L. casei* was observed. In our case it was fortunate that with the Bactec system presence of growth in blood cultures was evident within 3-4 days of incubation. In some cases such isolates may not have been identified correctly, or may have been discarded as contaminants. Bourne et al. have suggested that lactobacilli are deficient in those virulence factors permitting them to invade and multiply at sites other than their normal habitat.

The majority of the documented cases of endocarditis were treated with massive doses of benzylpenicillin, combined in some cases with an aminoglycoside or occasionally tetracycline or ampicillin. One patient was treated successfully with erythromycin alone. Our patient received benzylpenicillin initially, combined with tobramycin, but later these two agents were replaced by ampicillin and netilmicin. The isolate showed marked tolerance for ampicillin. Striking tolerance of antibiotics on the part of *Lactobacillus* isolates has been described by Bayer et al. In some of the recorded cases a higher than usual incidence of *L. casei* and *L. plantarum* was observed. This may be due to the frequency of the blood culture isolations of these species appearing to be infective endocarditis caused by this organism in a patient who had undergone insertion of a porcine bioprosthesis 4 years previously because of aortic stenosis. The endocarditis was treated successfully, but just over a year later the patient developed severe aortic regurgitation. On replacement of the valve it was found to be extensively calcified with markedly degenerated cusps with calcified excrescences. On electron microscopy of decalcified sections of the valve numerous rod-shaped bacteria were found embedded in the valve matrix. The strain of *L. casei* ss. *rhamnosus* responsible for the endocarditis on incubation in a 'calcifying solution' became encrusted with numerous spicular crystals within 14 days. It is suggested that these organisms may act as initiators of deposits of calcium hydroxyapatite in the porcine valves.

Should the apparent rarity of lactobacillaeemia in endocarditis be due to use of unsuitable culture media, it would be worth while to inoculate a specific *Lactobacillus* culture medium in parallel with the usual blood culture media. Failing this, in blood culture-'negative' cases of clinically obvious endocarditis at least the blood cultures should be subcultured on to specific *Lactobacillus* medium before being discarded. A 'negative' subculture following a significant rise in radioactive count in the Bactec system may indicate a *Lactobacillus* isolate. It is important to incubate the subcultures (on blood agar or *Lactobacillus* medium) for at least 48 hours, since some strains may fail to show visible growth after only 24 hours' incubation.

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