The Journal of Laryngology and Otology
December 1982. Vol. **96.** pp. 1103–1107

Cialit: A study

By A. L. PAHOR,* A. K. GANGOPADHYAY,† A. J. JONES‡ and M. J. ROBERTSON‡ (Birmingham)

Introduction

THIERSCH grafts and post-aural and meatal skin were used for drumhead repairs until the underlay technique was introduced by Shea. Autologus temporalis facia was found to be more reliable (Örtegren, 1959), interest in homologous materials was stimulated and Plester (1970) used homologous temporalis facia. Heterologous dura was used by Albrite and Leigh (1966). One of the authors (A.L.P.) has used the last two materials for tympanoplasty, both being preserved in Cialit (Smyth, Kerr and Pahor, 1974; Smyth, Kerr, Pahor and Law, 1975). A study into the bacteriological properties of Cialit was stimulated recently and this prompted the present report.

The first demonstration of the antibacterial value of mercury and its salts was made by Koch, and his experiments showed the disinfection of anthrax spores with mercuric chloride. The organic compounds were then introduced during the First World War; these generally were more antibacterial activity, and were less toxic and irritant, but they still lacked sporicidal activity. The use of these organic compounds is now limited mainly to two fields; as local antiseptics for topical application, and as preservatives for pharmaceutical products and industrial materials (Sykes, 1967).

The use of mercurial compounds for grafted materials in Otology is not new; John Swift Walker in 1887 used a solution of 1 : 500 of perchloride of mercury in distilled water and two drops of glycerine to the ounce to preserve the egg membrane, which he used to close perforations of the tympanic membrane (Pahor, 1979).

Methods and Materials

Cialit is 2-(ethylmercurimercapto)-benzoxazole-5-carboxylate.§ It may precipitate in acid solution; therefore, owing to the risk of absorption of carbon dioxide on prolonged storage, a 1 : 5000 aqueous solution buffered with sodium bicarbonate was used:

* E.N.T. Department, Dudley Road Hospital and Sandwell District General Hospitals, Birmingham.
† E.N.T. Department, Sandwell District General Hospital.
‡ Microbiology Department, Sandwell District General Hospital.
§ Hoechst Pharmaceuticals.

https://doi.org/10.1017/S0022215100093555 Published online by Cambridge University Press

Cialit	0.2 g.
Sodium bicarbonate B.P.	2.6 g.
Dilute hydrochloric acid q.s. to pH	7.2
Aqua Dest to	1 Litre

The solution was sterilized by filtration. Autoclaving at 115°C for 35 minutes is permissable, however.

Test Organisms

Clinical isolates of *Streptococcus faecalis, Branhamella catarrhalis, Clostridium welchii, Bacteroides fragilis* and an anaerobic Streptococcus were used, in addition to *Escherichia coli* N.C.T.C. 10418, *Staphylococcus aureus* N.C.T.C. 6571, *Pseudomonas aeruginosa* N.C.T.C. 10662, *Clostridium histolyticum* N.C.T.C. 503, *Clostridium sordellii* N.C.T.C. 6927, *Clostridium bifermentans* N.C.T.C. 506, and Bacillus species were collected from the laboratory environment.

The time required by mercury compounds to kill bacteria is dependent, amongst other factors, on the numbers of organisms present (Wilson and Miles, 1975). This was confirmed by a preliminary series of tests (Table I).

TABLE I

	Survival time in hours at a concentration of	
	10^3–10^4 C.F.U./cm.^{3}	10^5–10^6 C.F.U./cm.^{3}
Branhamella catarrhalis	Less than 1	8
Bacteroides fragilis	1	8
Staphylococcus aureus	4	8
Escherichia coli	4	8
Anaerobic Streptococcus sp.	4	8
Pseudomonas aeruginosa	8	8
Streptococcus faecalis	Greater than 24	Greater than 24
Clostridium sporogenes	Greater than 24	Greater than 24

In order to standardize the tests, suspensions in Cialit 10^4–10^5 colony forming units per cm.^{3} (C.F.U./cm.^{3}) were used. To achieve this, cultures were grown overnight in Robertson's cooked meat medium. Ten-fold dilutions were then prepared in 10 cm. allequots of Cialit. Controls were then prepared by cultivating 10 µl of each dilution on to Columbia blood agar plates. The suspensions in Cialit were then refrigerated at 4°C. After overnight incubation at 37°C the colonies on the blood agar plates were counted, and the dilution yielding between 100 and 1000 colonies per plate for each organism was chosen as the test (i.e. 10^4–10^5 C.F.U.s/cm.^{3} Cialit). All other dilutions were discarded.

The test suspensions were then sub-cultured as before at 1, 2, 14 and 28 days and the colony counts compared with the controls. (In earlier tests

https://doi.org/10.1017/S0022215100093555 Published online by Cambridge University Press

sequestrene—ethylenediamine tetra-acetic acid E.D.T.A.—was used in order to neutralize any Cialit carried over into the sub-cultures, but in practice this was found to be unnecessary.)

Results and Discussion

Results of the first series of tests are shown in Table II. As *Clostridium sporogenes, Streptococcus faecalis* and Bacillus species survived for more than 24 hours, 7 further clinical isolates of *Streptococcus faecalis*, 3 further species of Clostridia and 4 further Bacillus species were tested.

TABLE II

	Subculture interval in days			
	1	2	14	28
Streptococcus faecalis	++	++	+	−
Branhamella catarrhalis	−	−	−	−
Pseudomonas aerugirosa	−	−	−	−
Escherichia coli	−	−	−	−
Staphylococcus aureus	−	−	−	−
Clostridium welchii	−	−	−	−
Anaerobic Streptoccocus sp.	−	−	−	−
Clostridium sporogenes	++	++	++	++
Bacillus sp.	++	+	+	+
Bacteroides fragilis	−	−	−	−

++ = Growth equal to control
+ = Growth reduced at least ten-fold
− = No growth

The results are shown in Tables III, IV and V respectively. From these results it can be seen that the more readily sporing Clostridia and Bacillus species are not killed by a 1:5000 solution of Cialit at 4°C after 28 days. Some Streptococcus faecalis strains may survive for up to 14 days but are killed within 28 days.

The organisms which survived 1:5000 Cialit for 28 days at 4°C were tested in 1:1000 Cialit without any significant improvement in results (Table VI).

TABLE III

	Subculture interval in days			
	1	2	14	28
Streptococcus faecalis 1	++	+	−	−
Streptococcus faecalis 2	++	++	−	−
Streptococcus faecalis 3	++	++	−	−
Streptococcus faecalis 4	++	++	−	−
Streptococcus faecalis 5	++	++	−	−
Streptococcus faecalis 6	++	++	−	−
Streptococcus faecalis 7	++	++	−	−

https://doi.org/10.1017/S0022215100093555 Published online by Cambridge University Press

TABLE IV

	Subculture interval in days			
	1	2	14	28
Clostridium sporogenes	++	++	++	++
Clostridium sordellii	++	++	++	++
Clostridium bifermentans	++	++	+	+
Clostridium histolyticum	—	—	—	—

TABLE V

	Subculture interval in days			
	1	2	14	28
Bacillus sp. 1	++	+	+	+
Bacillus sp. 2	—	—	—	—
Bacillus sp. 3	+	+	+	+
Bacillus sp. 4	+	+	+	+

TABLE VI

	Subculture interval in days			
	1	2	14	28
Streptococcus faecalis	++	++	+	—
Clostridium sporogenes	++	++	++	++
Clostridium sordellii	+	+	+	+
Clostridium bifermentans	++	++	+	+
Bacillus species	++	++	+	+

This study shows, therefore, that most bacteria likely to be present as contaminants in material stored for grafting will be killed by exposure to 1 : 5000 Cialit within 24 hours at 4°C, even when the bacteria are present in moderately high numbers.

Conclusions

The conclusions derived from this study are as follows:

(1) All vegetative bacteria investigated were killed by exposure to the Cialit solution at a concentration of 1 : 5000 at 28 days.

(2) If spore-bearing organisms are introduced with the dura organisms, these are likely to be still present after 28 days' storage in Cialit solution at 1 : 5000.

https://doi.org/10.1017/S0022215100093555 Published online by Cambridge University Press

(3) It is recommended, therefore, that the dura is introduced into the Cialit solution with maximum aseptic care, and this solution then sub-cultured aerobically and anaerobically on the second day. If this should show spore-bearing organisms to be present, it should be discarded. If only faecal streptococcal or other vegetative bacteria are present at this sub-culture on the second day, it would appear from the experiments that the dura can be used after further storage at 4°C at the 28th day.

Summary

Cialit is used for the preservation of homologous dura. All vegetative bacteria investigated were killed by exposure to Cialit 1 : 5000 solution, but spore-bearing organisms are not killed at 28 days.

REFERENCES

ALBRITE, J. P. and LEIGH, B. G. (1966) Dural homograft (allostatic) myringoplasty. *Laryngoscope,* **76:** 1687–1693.

ÖRTEGREN, U. (1959) cited by SALER, BERGT (1968) Tympanic membrane grafts of full thickness skin, fascia and cartilage in its perichondrium. *Acta Otolaryngologica, Supplement* 244.

PAHOR, A. L. (1979) Blast injuries to the ears: An historical and literary review. *Journal of Laryngology and Otology,* **92:** 225–251.

PLESTER, D. (1970) Tympanic membrane homografts in ear surgery. *Acta Otolaryngologica Belgica,* **24:** 34–37.

SHEA, J. J. Jnr. (1960) Vein graft closure of ear drum perforation. *Journal of Laryngology and Otology,* **74:** 358–362.

SMYTH, G. D. L., KERR, A. G. and PAHOR, A. (1974) Homologous and Heterologous Materials in Tympanoplasty. Read at the Xth World Congress, Venice, May 1973. Editors: M. Arslan and V. Ricci, *Otolaryngology, Excerpta Medica,* Amsterdam, pp. 291–293.

SMYTH, G. D. L., KERR, A. G., PAHOR, A. and LAW, K. (1975) Ossiculotympanic transplantation. *Laryngoscope,* **85:** 540–550.

SYKES, G. (1967) *Disinfection and Sterilization,* Spon Ltd., London, p. 412.

WILSON, G. S. and MILES, A. A. (1975) *Principles of Bacteriology and Virology,* 6th E. S. London, Arnold, Vol. I, p. 173.

Reprints from:
Ahmes L. Pahor,
Department of Otorhinolaryngology,
Sandwell District General Hospital,
Lyndon,
West Bromwich,
Birmingham.

https://doi.org/10.1017/S0022215100093555 Published online by Cambridge University Press

https://doi.org/10.1017/S0022215100093555 Published online by Cambridge University Press