BACTERIAL CONTAMINATION OF NYLON CORNEAL SUTURES

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SUMMARY

We report the findings of a prospective study into the bacterial contamination of monofilament nylon sutures removed from corneal wounds following cataract surgery. Sutures were classified as tight, loose or broken at the time of removal. Loose and broken sutures showed significantly more bacterial contamination than tight sutures ($p<0.001$, chi squared). Positive cultures were obtained from 2 (6.2%) of 32 tight sutures, 14 (38.9%) of 36 loose sutures and 11 (37.9%) of 29 broken sutures. *Staphylococcus epidermidis* was the most commonly isolated organism (isolated in pure growth from 22 (81.5%) of 27 positive cultures). These findings may explain the occasional association of biodegraded corneal monofilament nylon sutures and suppurative keratitis and highlight the potential risk of seeding a suture track infection at the time of suture removal. They also emphasise the need for prophylactic topical antibiotic when removing biodegraded sutures.

Conventional extracapsular cataract surgery is frequently performed via a corneal incision. Monofilament nylon (MFN) is a popular suture material for closing such wounds. However, redundant MFN sutures may occasionally facilitate the development of suppurative keratitis.[1] The prevalence of bacterial contamination of retained MFN sutures, and hence the risk of corneal infection, is unknown. We have therefore conducted a prospective study of the bacterial contamination of MFN sutures at the time of their removal from the corneal wounds of cataract surgery.

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PATIENTS AND METHODS

Individual interrupted 10/0 monofilament nylon sutures were harvested from the corneal wounds of eyes that had undergone extracapsular cataract extraction. Sutures were classified as tight, loose or broken. Thirty-two tight, 36 loose sutures and 29 broken sutures were collected. The approximate size of these groups was determined prior to the start of the study following discussions with a microbiologist and a statistician. Suture removal was based on clinical need. For tight sutures removal was for relief of surgically induced astigmatism and was usually performed 2–3 months post-operatively. For loose and broken sutures removal was for relief of irritation and corneo-conjunctival inflammation. Sutures were removed at the slit lamp using a sterile technique. Tight and loose sutures were cut with a 25 gauge needle, mounted on a 2 ml syringe as a handle. Sutures were extracted from the cornea using flame-sterilised microforceps and immediately placed into Brain Heart Infusion broth (Unipath Ltd) which was incubated at 37 °C for 24 hours. Each broth was then subcultured onto blood agar and chocolate agar incubated at 37 °C in CO_2, blood agar incubated at 37 °C anaerobically and glucose Sabaraud agar in air at room temperature. All plates were incubated for 5 days and examined daily for bacterial and fungal growth. Isolates were identified by standard techniques; sensitivity tests were performed using comparative disc diffusion ('Stokes'') method.

To avoid contact between the arms of the microforceps and the inside of the culture bottle, and to overcome the reluctance of sutures to transfer from forceps to broth, sutures were placed onto the rubber lining of the culture bottle cap. Having tightly replaced this cap the suture was shaken into the broth itself. Only one suture per patient was included in the study. Patients with suspected corneal infection

Table I. Bacterial contamination of corneal monofilament nylon sutures after cataract surgery, and organisms involved

Type of suture	Number	Outcome of culture		Organisms isolated		
		Sterile (%)	Positive (%)	*S. epidermidis* only	*S. epidermidis* plus other	Other
Tight	32	30 (93.8)	2 (6.2)	2	0	0
Loose	36	22 (61.1)	14 (38.9)	11	1[a]	2[c]
Broken	29	18 (62.1)	11 (37.9)	9	2[b]	0
Total	97	70 (72.2)	27 (27.8)	22	3	2

[a] *S. epidermidis* (three types) and *Bacillus* sp.
[b] One suture grew *S. epidermidis* and Group B *Streptococcus*, one grew *S. epidermidis* (two types) and *Streptococcus mitis*.
[c] One suture grew a *viridans*-type streptococcus and one grew a Gram-negative bacillus.

or use of antibiotic within the last 2 weeks were excluded. Conjunctival swabs were not taken.

RESULTS

A positive bacterial culture was obtained from 2 (6.2%) of the 32 tight sutures, from 14 (38.9%) of the 36 loose sutures and from 11 (37.9%) of the 29 broken sutures (Table I). The incidences of bacterial contamination of loose and of broken sutures were both significantly greater than that of tight sutures ($p<0.001$ in each case, chi-squared). The contamination rates of loose and broken sutures were not significantly different from each other ($p>0.5$).

The most frequently identified organism was *Staphylococcus epidermidis*. This was isolated in 25 (92.6%) of the 27 culture-positive cases. In 22 of these cases this was the only organism isolated, although in 1 case from each group two different strains of *S. epidermidis* were isolated from a single suture. In 5 cases other organisms were isolated. One loose suture yielded a mixed growth of three strains of *S. epidermidis* with *Bacillus* sp. A *viridans*-type streptococcus and a Gram-negative bacillus (which failed to grow for full identification) were isolated from one loose suture each. One broken suture yielded both *S. epidermidis* and a Group B beta-haemolytic streptococcus and one a mixture of two types of *S. epidermidis* and *Streptococcus mitis*. All organisms were sensitive to at least one of the following antibiotics: chloramphenicol, gentamicin, erythromycin and flucloxacillin. No patient from whom sutures had been collected suffered subsequent suppurative keratitis.

DISCUSSION

Monofilament nylon is used widely in the United Kingdom for the closure of corneal incisions after cataract surgery. It offers high elasticity, sustained tensile strength and little tissue reaction within the cornea. Although classified as a non-absorbable material it does slowly biodegrade.[1,2] Amide linkages within the polymer udergo hydrolysis mediated by lysozymal enzymes.[1,2] This results in fretting and cracking of sutures with progressive loss of tensile strength,[2] and in time sutures loosen and may break.[1,3] Occasionally such biodegraded MFN sutures provide a nidus for the development of suppurative keratitis.[1] This complication has also been reported shortly after suture removal, presumably due to seeding of microorganisms into the suture track.[4] These phenomena suggest that retained biodegraded corneal MFN sutures may harbour bacteria. Our findings confirm this suspicion and quantify the problem.

Most isolates were of low-pathogenicity bacteria which commonly colonise the skin and conjunctival sac. Their significance is difficult to evaluate but the ability of such organisms to cause infection when associated with foreign material is well recognised and especially the affinity of *S. epidermidis* for synthetic material such as plastics.[5,6,8–11] In addition, *S. epidermidis* contamination of synthetic material has been shown to facilitate colonisation by other organisms including *Pseudomonas aeruginosa*.[7–10] Gram-negative bacilli such as *Pseudomonas* spp. (and Gram-positive streptococci) are among the most virulent corneal pathogens and are capable of producing severe suppurative keratitis. The increased incidence of bacterial contamination of loose and broken sutures (38.9% and 37.9% respectively) over that of tight sutures (6.2%) therefore suggests that the former are at increased risk of infective complications.

Broken sutures tend to be removed late, for relief of ocular irritation, and are usually biodegraded. Broken sutures are also often associated with a local corneal epithelial defect. This in combination with suture contamination provides conditions particularly favourable for the development of suppurative keratitis. Loose sutures also demonstrated frequent contamination which may relate both to biodegradation and to their tendency to accumulate mucus. Tight corneal sutures are usually free of bacterial contamination. This is probably because they are removed relatively soon after surgery for relief of induced astigmatism. At this stage they are unlikely to have undergone significant biodegradation and are covered by corneal epithelium. The latter feature is confirmed clinically by absence of staining on instillation of fluorescein.

These findings provide a further indication that corneal MFN sutures should be removed once

wound healing is complete and before significant suture biodegradation occurs. However, the optimal regime of prophylactic topical antibiotic at the time of suture removal remains uncertain. In the light of our findings we feel that a single dose of topical antibiotic ointment may suffice when removing tight sutures. The aim here is to prevent infection whilst the small iatrogenic corneal abrasion heals. A short course of topical antibiotic may, however, be advisable after removing loose or broken sutures to guard against the possibility of having implanted suture-borne bacteria into the cornea at the time of removal. Sutureless cataract surgery will, of course, dispense with the problem of suture contamination altogether.

This study was instigated following an idea by Mr D. L. Boase, Consultant Ophthalmic Surgeon, Queen Alexandra Hospital, Portsmouth.

Key words: Bacterial infections, Cornea, Nylon, Sutures.

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