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Jones' Lacrimal Canalicular Bypass Tubes: Twenty-Five Years' Experience

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Summary

The results after implantation of Lester Jones canalicular bypass tubes in 326 eyes (310 patients) are reviewed. The bypass tubes were implanted after canalicular obstruction from a variety of causes, of which post-herpetic or post-traumatic obstruction accounted for one-half of all cases.

With up to 23 years' follow-up, replacement of the bypass tube was needed in 142 (44%) patients, the majority after spontaneous loss. The median interval to first replacement may be estimated as about ten years for spontaneous loss and five years for all causes. Despite complications and the need for further surgery in many patients, most patients (91%) were pleased with the functional result of surgery.

The principles, techniques and complications of lacrimal canalicular bypass surgery are presented and the long-term care of bypass prostheses is discussed.

The Jones' tube,[1] or similar lacrimal canalicular bypass tubes, provides the most successful method for lacrimal drainage where canalicular obstruction or malfunction is present. Before introduction of the Jones' tube, many techniques for achieving tear drainage in the absence of functional canaliculi had been described,[2] but the majority of these methods produced poor results.

The indications and results of lacrimal canalicular bypass surgery are presented for patients in the Lacrimal Clinic at Moorfields Eye Hospital. Practical aspects of surgical technique and patient after-care are also discussed, based upon long-term experience with these devices.

Patients and methods

Three hundred and ten patients (132 males, 178 females) were identified, from the records of the Lacrimal Clinic at Moorfields Eye Hospital, as having undergone Jones' tube implantation between 1965 and 1980. The full clinical notes were available for review in most cases.

Surgical Techniques

Through an external approach, a large rhinostomy was created and, where necessary, the middle turbinate was resected. If both leaves of the medial canthal tendon had been disrupted, the lower lid was fixed posterosuperiorly, either by repair of the posterior limb of the tendon or by the attachment to a trans-nasal wire. After suturing the posterior mucosal flaps, a guide-wire was passed into the nose either from the lower canalicular ampulla (opened by a 3-snip procedure; 113 cases) or from the site of the caruncle (203 cases); the caruncle being resected in 119 (59%) of the latter cases. The guide-wire track was enlarged using an Elliott trephine[3] or a Graefe knife and a bypass tube passed over the guide wire. Polythene tubes were used (37% of cases) where tissue swelling was pronounced or nasal anatomy very

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Table I. *Causes of lacrimal drainage obstruction requiring Jones' tube implantation in 326 eyes*

Cause of obstruction to Lacrimal Drainage	*Number of eyes*	*Proportion of total*
Post-herpetic	84	26%
Post-traumatic	77	24%
Congenital	34	10%
Post-irradiation	33	10%
Failed lacrimal surgery	33	10%
Other known causes	37	11%
Trachoma	9	
Stevens-Johnson syndrome	7	
Facial nerve palsy	5	
Basal cell carcinoma	4	
Staphylococcal lid disease	2	
Chemical burns	2	
Syphilis	1	
Osteoma	1	
Maxillary sinusitis	1	
Papillomatosis	1	
Lid abscess	1	
TRIC	1	
Nasal sarcoid	1	
Linear IgA disease	1	
Unknown cause	28	9%

abnormal. In later cases the tube was anchored by a transcutaneous suture looped several times around the neck of the tube; this suture being removed at seven to ten days after surgery.

When postoperative swelling had subsided, polythene tubes were generally exchanged for glass and the patients reviewed every six-months to one year.

Results

Patient Characteristics

The cause for obstruction of lacrimal drainage was evident in 91% of 326 eyes, with Herpes Simplex infection and trauma accounting for one-half of all cases (Table I). The age at presentation ranged from two to 82 years, with significant variation (One-way analysis of variance: $F = 24.0$, $p<0.001$) between the average values for different causes of epiphora (Table II; Figs 1A & 1B).

The duration of symptoms varied from two months to 60 years at the time of presentation (Fig. 1C), with an average of 7.8 years and a median of three years. Previous lacrimal drainage surgery had been performed, between one and six times, in 149 patients; the time between last operation and implantation of a bypass tube varying between 10 weeks and 37 years (mean 3.8, median 1.5 years).

With only five exceptions, bypass tubes were not implanted in children below the age of 13 years, the average age at implantation being 40 years (median 41; range 13–83 years). The proportion of females was slightly higher in the earlier decades (Fig. 1D).

Operative Results

The surgical details and positioning of the tube were similar in groups with different causes of canalicular obstruction (Table III) and implantation was completed in all patients without significant intra-operative complication. The follow-up interval varied from one month to 23 years, with a mean value of 4.5 years and median of 2.7 years (Fig. 2).

Table II. *Patient characteristics in relation to the cause of lacrimal drainage obstruction*

	Cause of obstruction to lacrimal drainage							
	Herpes	*Trauma*	*Radiation*	*Congenital*	*Failed surgery*	*Other known*	*Unknown*	*All causes*
Number of patients	83	77	32	30	31	32	25	310
Males	25 (30%)	52 (68%)	10 (31%)	17 (57%)	6 (19%)	17 (53%)	5 (20%)	132 (43%)
Females	58 (70%)	25 (32%)	22 (69%)	13 (43%)	25 (81%)	15 (47%)	20 (80%)	178 (57%)
Age at Presentation (Years)								
Mean	34.7	35.2	54.3	22.3	57.9	43.0	45.9	(39.7)
Standard deviation	16.1	14.1	12.8	11.5	11.2	18.9	15.1	(17.7)
Median	33	32	52	18	59	44	45	40
Range	2 to 68	13 to 61	17 to 82	6 to 51	33 to 77	9 to 73	17 to 69	2 to 82
Number of affected eyes	84	77	33	34	33	37	28	326

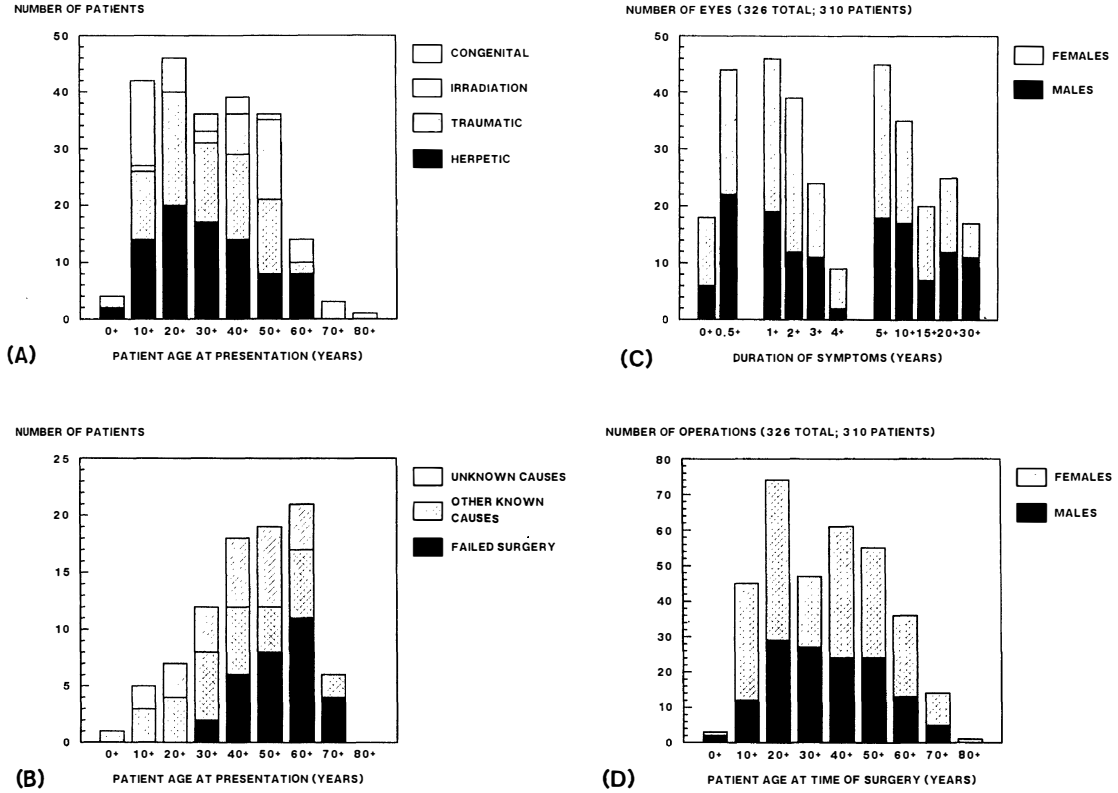

Fig. 1. *Presenting characteristics for 310 patients undergoing implantation of Jones' tubes (326 eyes).*

The prosthesis required replacement (1–7 times) in 142 (44%) cases; this being to a total of 227 times. The average time to first replacement of a tube was 17 months (range one day to almost 12 years) and the interval to subsequent replacements was generally less (Table IV).

Twenty-two patients (7%) declined further bypass tubes (between five weeks and $11\frac{1}{2}$ years after initial implantation), many of

Table III. *Surgical characteristics in relation to the cause of lacrimal drainage obstruction*

	Cause of obstruction to lacrimal drainage							
	Herpes	*Trauma*	*Radiation*	*Congenital*	*Failed surgery*	*Other known*	*Unknown*	*ALL CAUSES*
Position of Canalicular Bypass Tube								
Caruncle	29 (36%)	32 (43%)	14 (44%)	14 (43%)	11 (34%)	16 (43%)	9 (33%)	125 (39%)
Fornix	16 (20%)	21 (28%)	7 (22%)	13 (41%)	6 (19%)	10 (27%)	5 (19%)	78 (25%)
Punctal	36 (44%)	22 (29%)	11 (34%)	5 (16%)	15 (47%)	11 (30%)	13 (48%)	113 (36%)
Unknown position	3	2	1	2	1	—	1	10
Caruncule ctomy	28/79 (35%)	29/75 (39%)	13/32 (41%)	14/32 (44%)	11/32 (34%)	15/26 (58%)	9/27 (33%)	119/303 (39%)
Type of Bypass Tube Implanted								
Polythene	34 (43%)	22 (29%)	11 (34%)	12 (36%)	11 (34%)	15 (41%)	14 (52%)	118 (37%)
Glass	45 (57%)	53 (71%)	21 (66%)	21 (64%)	21 (66%)	22 (59%)	13 (48%)	197 (63%)

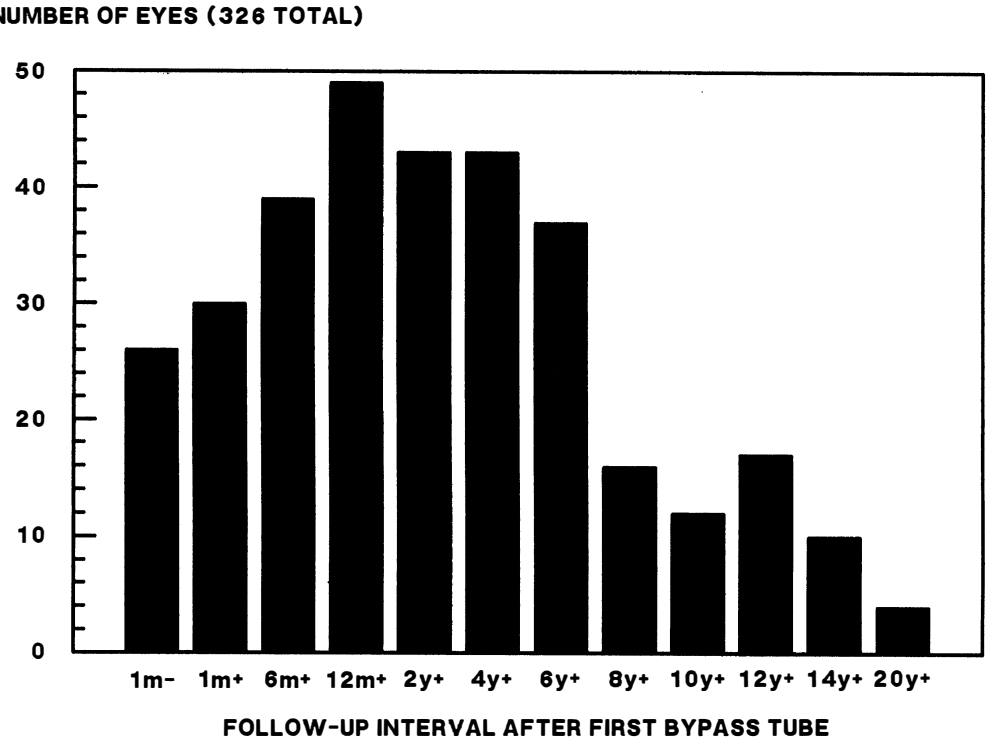

Fig. 2. *Follow-up intervals after first implantation of Jones' tubes in 326 eyes.*

these patients having had the tube replaced on several occasions prior to their final visit. Eight of these 22 patients (36%) had fair or good control of epiphora without a bypass tube in place.

Eighty per cent of patients were very pleased with the control of symptoms by the prosthesis and 11% were moderately pleased.

Discussion

The use of a canalicular bypass tube is indicated where there is inadequate canalicular tissue to provide a functional anastomosis in patients with canalicular obstruction (by disease or by a congenital absence of tissues) or where normal tear flow is impeded by a lack of the orbicularis pumping mechanism (as, for example, in facial palsy). In practice, common indications are congenital cases and after Herpes infection, trauma, irradiation or failed lacrimal surgery (Table I). There was a significant bias with respect to sex ($\chi^2 = 42.5$, $p<0.001$), with trauma being more frequent

Table IV. *Interval between replacement or positioning of Jones' tubes in 142 eyes (232 replacements)*

	Time interval to reposition/replacement no.					
	1	*2*	*3*	*4*	*5*	*7*
Mean	1.4	0.76	0.57	2.2	0.40	7.9
Standard dev'n	2.5	1.0	0.96	2.4	0.30	—
Median	3.2	0.42	0.20	0.79	0.44	—
Range	0.09 to 11.9	0.01 to 6.4	0.01 to 3.7	0.21 to 6.2	0.08 to 0.68	—
Number of eyes	142	51	22	12	3	1

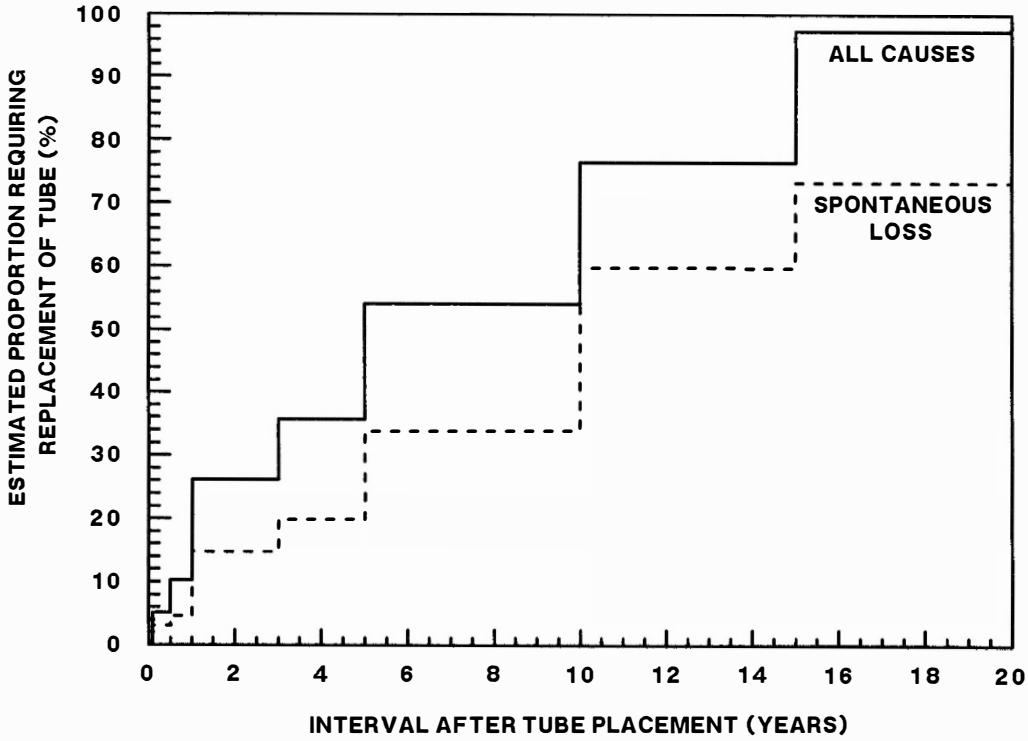

Fig. 3. *Life-table analysis for replacement or repositioning of Jones' tubes, based on results from 326 cases.*

in men and with Herpes, radiation or failed lacrimal surgery being more common in women (Table II).

The age at presentation varied significantly (Table II). Patients with congenital obstruction presented at a significantly ($p<0.001$) younger age and patients with canalicular obstruction after irradiation or failed surgery were significantly older than other groups (Figs 1A & 1B).

Lacrimal canalicular bypass tubes are subject to many postoperative complications[1,4–10] and review of our results after Jones' tube implantation in 326 eyes shows the outcome to be rather variable.

Although over one-half of tubes in the

Fig. 4. *Variations in the positioning of Jones' tubes at the medial canthus: (a) Intra-punctal placement and (b) medial forniceal placement, with carunculectomy.*

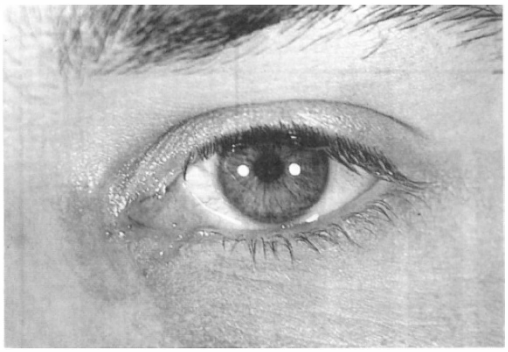

Fig. 5. *Florid granulations and tissue overgrowth around a Jones' tube.*

present series did not require replacement, this was often necessary after spontaneous loss (Fig. 3) or, less commonly, when tissue overgrowth occurred. After first replacement of the tube, the interval to subsequent replacements was generally less (Table IV); tubes liable to repeated malposition or loss generally being those in which correct placement of the tube is most difficult (with abnormal medial canthal or nasal anatomy).

From life-table analysis, it may be estimated that, if followed for two decades, almost all bypass tubes will require replacement at least once and that the risk of spontaneous loss continues for many years after surgery (Fig. 3). An estimated median time to a first replacement for spontaneous loss is about ten years and to a first replacement for all causes is about five years (Fig. 3).

We consider there are several contraindications to implantation of bypass tubes: Because cooperation of the recipient is required for after-care of Jones' tubes, their use is best avoided in children under teenage or in the mentally-retarded. Similarly, implantation is probably inappropriate where after-care is unavailable, most prostheses eventually requiring some form of active management.

Where a Jones' tube is implanted, many complications may be avoided by attention to details of surgical technique and by adequate education of patients in the management of their prosthesis. Based upon experience with the present series of bypass tubes, we make the following recommendations.

Principles of Surgical Technique

The rhinostomy should extend in front of the anterior lacrimal crest and inferiorly to below the lacrimal sac fossa, the large bone defect allowing flexibility in the positioning of the bypass tube.

The proximal end of the tube may be sited within the canalicular ampulla, enlarged by a small three-snip procedure (Fig. 4a), or below the bulk of the caruncle, in the lacrimal lake (Fig. 4b). Because most flow through the tube is due to gravity,[11] the tube should be directed as infero-medially as possible and the distal end placed to clear the nasal septum or middle turbinate.

Malpositioning in the transverse plane can cause many problems. Antero-medial direction causes abrasion between the flange and the ocular surface, the inflammation so caused leading either to surface ulceration or to engorgement and overgrowth of the episclera or plica semilunaris. The inflamed tissues may act as an occlusive 'flap-valve' upon the proximal end of the tube or may heal across the end of the tube, burying the latter in granulation (Fig. 5) or scar tissues. Initial malposition of the tube was probably significant in many of the 51/227 (22%) replacements required because of tissue-overgrowth. Postero-medial orientation tends to direct the proximal end of the tube over the edge of the lid or above the tear lake; such malposition being the reason for replacement in 11/232 (5%) cases.

Principles of Postoperative Management

Patients should be instructed forcibly to aspirate water through the tube daily and to place a finger at the medial canthus, over the

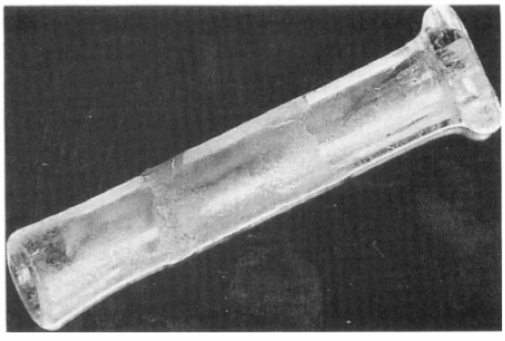

Fig. 6. *Fibrous sheath formed around a Jones' tube, neglected through default to follow-up.*

end of the tube, whenever they sneeze or cough.

If the prosthesis shifts laterally, patients should attempt to replace it, or should seek medical attention. Whilst the tract remains patent for several days after removal of a tube, it is often possible to replace the bypass tube (placing it over a fine guide wire) using either topical or infiltrative local anaesthesia. Prolonged removal of the prosthesis generally leads to stenosis or closure of the fistula and recurrence of watering.

At annual, or more frequent, reviews, the bore of the bypass tube should be cleared of accumulated mucus by the use of a plastic bristle and forceful irrigation with saline. If the outer surface is not cleaned a fibrous sheath tends to form (Fig. 6), this often causing recurrent infections.

Despite the complications and necessity for further surgical intervention in many cases, the majority (91%) of patients were pleased with the results of canalicular bypass surgery. In view of the considerable patient satisfaction (and the ease with which the prosthesis can be removed, if so wished) the many cases with extreme duration of symptoms prior to referral (Fig. 1C) is to be regretted.

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