

SNP Best-set Typesetter Ltd.

age Extent: 5pp

Original Article

National survey on the management of lacrimal canalicular injury in the UK

Thomas Ho XX and Vickie Lee MA FRCOphth
Central Eye Department, Central Middlesex Hospital, London, UK

1

ABSTRACT

Purpose: The management of lacrimal canalicular injury is controversial. It is believed that practice varies widely among surgeons.

Methods: One hundred and twenty National Health Service-based Consultant Ophthalmologists with oculoplastic interest across the UK were identified via the website <http://www.specialistinfo.com>, which is a website that asks UK consultants to identify their areas of subspecialty interests. Questionnaires were sent out to them to determine caseload, intraoperative techniques (magnification, suture and stents) and postoperative management (antibiotic use, stent placement and replacement and secondary lacrimal surgery) of patients with canalicular injuries.

Results: Eighty-nine (74%) completed questionnaires were returned and analysed. Most (63%) of the respondents treated between one and five canalicular injuries over the past year. Thirty-eight (43%) of them would repair a monocanalicular injury only if the lower canaliculus was involved and 36 (40%) respondents would always repair a monocanalicular injury. Eighty-two (92%) respondents used magnification during surgery. Fifty-one (57%) respondents would never consider using the pigtail probe. Eighty-five (96%) would use the bubble test and/or fluorescein dye to locate the severed medial canalicular end. Vicryl or dextron was the suture of choice for 76 (85%) and 63 (71%) respondents for repairing pericanalicular and canalicular tissues, respectively. Thirteen (14.6%) respondents did not stent their canalicular repairs. Forty-seven (53%) routinely used prophylactic antibiotics. Sixty-eight (76%) respondents would wait between 3 and 12 months before undertaking further lacrimal surgery.

Conclusion: This study confirmed that management of lacrimal canalicular injury varies widely among surgeons in the UK.

Key words: xxxxxxxx.

2

INTRODUCTION

Lacerations to the lacrimal canaliculi are the most common type of traumatic injury to the lacrimal system. Successful management of these injuries depends on early, accurate diagnosis, as well as good surgical technique in order to minimize the incidence of post-traumatic epiphora. The principles of surgery are accurate approximation of the severed ends to encourage mucosal healing.¹ However, the surgical technique to achieve these goals varies among oculoplastic surgeons. In this study, we aim to discover the spectrum of the surgical management of these injuries among lacrimal surgeons in the UK.

METHODS

One hundred and twenty National Health Service-based Consultant Ophthalmologists with oculoplastic interest across the UK were identified via website <http://www.specialistinfo.com>.

Questionnaires (Fig. 1) were sent out to the consultants. Respondents were asked to estimate the caseload over the past year. Questions aimed to identify intraoperative techniques included the use of magnification (loupes, microscope or none) during the repair, techniques used for locating the medial end of the severed canaliculus including specifically the employment of the pigtail probe, suture materials used, attempts at direct canalicular mucosal anastomosis and stenting (none, mono- or bicanalicular). Questions were also asked on the postoperative management including the routine use of prophylactic intraoperative and postoperative antibiotics, duration of stent placement and replacement of lost stents and the earliest date for lacrimal surgery after injury for severe epiphora.

1 Please estimate the number of canalicular injuries you have treated in the past year.

None 1–5 5–10 10–20 >20

2 Would you routinely repair a monocanicular injury?

No Only if lower canaliculus involved

I would repair both upper/or lower canalicular injury

3 Do you use magnification for canalicular repair?

No Surgical loupes Microscope

4 Would you consider using the pigtail probe?

Never Occasionally Always

5 If you have difficulty locating the medial end of the severed canaliculus, have you used any of the following techniques?

Bubble test Fluorescein dye Other (Please specify)

6 Please specify your choice of sutures for

Pericanalicular tissues

Canalicular wall

7 Do you routinely stent your repairs?

No Marsupialization of medial end

Monocanicular stent (Please specify)

Bicanicular stent (Please specify)

8 How long would you ideally leave the stent in place for?

<6 weeks 6 weeks–3 months >3 months

9 If the stent was lost in within the first postoperative week, would you consider replacing the stent?

No Yes Other (Please specify)

10 If a monocanicular repair fails and the patient complains of severe epiphora, how long would you wait before undertaking lacrimal drainage surgery?

<3 months 3–6 months 6–12 months >1 year

11 Do you routinely use antibiotic prophylaxis in eyelid repair?

No Intraoperative antibiotics Postoperative antibiotics

12 Please add any additional comments below.

*Many thanks for completing this questionnaire.
Please return in the enclosed stamped envelope to:*

*Miss Vickie Lee MA FRCOphth
Consultant Ophthalmic Surgeon
Central Eye Unit
Central Middlesex Hospital
London
NW10 7NS*

7 Figure 1. Questionnaire.

RESULTS

There was a 77% (92/120) response. Three were excluded as the forms were not completed. Eighty-nine (74%) completed questionnaires were analysed. A summary of the main responses is shown in Table 1. Seventeen (19%) respondents

treated none, 57 (63%) of the consultants treated between 1 and 5, 1 (12%) treated between 5 and 10, 2 (2%) treated between 10 and 20 and 1 treated over 20 canalicular injuries over the past year. One respondent did not state the number of injuries treated.

Thirteen (15%) respondents would not repair an upper or lower monocanicular injury; 38 (43%) would only repair a monocanicular injury if the lower canaliculus was involved; 36 (40%) would always repair a monocanicular injury.

Seven (8%) respondents used no magnification for canalicular repair. Eighteen (20%) respondents routinely used surgical loupes and 10 (56%) would use the operating microscope. Eleven (12%) responded that they used both types of magnifiers. One used an optivisor.

Fifty-one (57%) respondents would never consider using the pigtail probe, and 35 (39%) would occasionally consider using this device. There were two respondents who would routinely use the probe.

Consultants were asked about various techniques used for locating severed canaliculus. Eighty-five (96%) respondents would use either the bubble test or the fluorescein dye. Other techniques were mentioned that included injection of vision blue, saline, healon, prednisolone forte or milk through the intact canaliculus to locate the cut medial end. Some used adrenaline or phenylephrine drops to blanch the tissues, or consider delaying the repair for better visualization.

Seventy-six (85%) respondents preferred using 6/0 or 7/0 vicryl or dexion sutures, 3 (3%) preferred silk and 10 (12%) did not specify a suture of choice for repairing pericanalicular tissues. Six (7%) respondents would not suture the canalicular wall, 63 (71%) would use 7/0 or 8/0 vicryl/dexion and 4 (4%) would use nylon or another monofilament suture.

Thirteen (14.6%) respondents would not routinely stent their canalicular repairs, 46 (51.7%) respondents preferred to use a monocanicular stent and 8 (9%) respondents would use a bicanicular stent. Nineteen (21.3%) respondents stated they would use both. Of the monocanicular stents, the Mini-Monoko was the stent of choice among potential 'stenters' (39/73). Other types of monocanicular stents were mentioned; they included the Bernard and O'Donoghue tubes. Types of bicanicular stents used by the respondents included Crawford, Ritleng, Bernard and O'Donoghue tubes.

Of the 73 'stenters' 8 (11%) respondents would leave a stent *in situ* for less than 6 weeks, 51 (70%) respondents preferred a stenting period of 6 weeks to 3 months and 14 (19%) respondents would leave the stent *in situ* for more than 3 months. Forty-two (47%) respondents stated that they do not routinely use prophylactic antibiotics. Six (7%) respondents use intraoperative antibiotics, 31 (35%) respondents use postoperative antibiotics and 10 (11%) respondents use both intra- and postoperative prophylactic antibiotics for canalicular repair.

In the scenario that should the patient have symptomatic epiphora after a failed monocanicular repair, 6 (7%)

3

4

Table 1. A summary of responses and percentages in the survey

| Survey topics | First (upper row of each topic) and second (lower row) highest responses | No. (%) of respondents (out of 89 unless stated otherwise) |
|---|---|--|
| Q1: Numbers of canalicular injuries treated in the past year? | 1–5 None | 57 (63) 17 (19.1) |
| Q2: Routinely repair a monocanalicular injury? | Only if lower canaliculus involved I would repair both upper or lower canalicular injury | 38 (42.7) 36 (40.4) |
| Q3: Use of magnification for canalicular repair? | Yes No | 80 (92) 7 (8) |
| Q4: Usage of pigtail probe? | Never Occasionally | 51 (57.3) 35 (39.3) |
| Q5: Methods for locating the severed canaliculus? | Fluorescein dye Bubble test | 39 (43.8) 7 (7.9) |
| Q6: Specified choice of sutures for repair (pericanalicular tissues)? | Vicryl Dexon | 72 (80.9) 4 (4.5) |
| Q7: Routinely stent your repairs? If so, which type? | Monocanalicular stent No | 46 (51.7) 13 (14.6) |
| Q8: Ideal stenting period (out of 73 respondents)? | 6 weeks to 3 months >3 months | 51 (69.8) 14 (19.2) |
| Q9: Stent replacement if lost within the first week after surgery? | Yes No | 38 (52.1) 30 (41.1) |
| Q10: Secondary lacrimal surgery if initial repair fails, and there is symptomatic epiphora? | 6–12 months 3–6 months | 36 (40.4) 32 (36) |
| Q11: Routine antibiotic prophylaxis in eyelid repair? | No Postoperative antibiotics | 42 (47.2) 31 (34.8) |

respondents would perform further lacrimal surgery within 3 months; 32 (36%) respondents would wait between 3 and 6 months; 36 (40%) respondents would prefer to wait between 6 and 12 months and 6 (7%) respondents would wait more than 1 year before undertaking further lacrimal surgery.

DISCUSSION

Many approaches towards the management of canalicular injury have been described including lid repair with *laissez faire*,² canalicular exteriorization,³ mono- or bicanalicular stenting, with or without mucosal anastomosis (direct suturing of the canalicular mucosa) and even immediate conjunctival/canaliculo-dacryorhinostomy.⁴ Regardless of the management approach, careful preoperative assessment and meticulous surgery are required to reduce the incidence of epiphora and poor cosmesis. It is generally accepted that the chances of achieving postoperative canalicular patency is enhanced by accurate approximation of pericanalicular tissues, but there is some divergence regarding the role of direct mucosal anastomosis and endocanalicular support with stents.

In Reifler's survey of 281 cases of 14 series, there is a higher incidence (72%) of lower canalicular lacerations.⁵ Kennedy *et al.*⁶ and Canavan and Archer⁷ both found that patients with injuries to both canaliculi were associated with a worse prognosis than those with single-canalicular injuries.

There has always been controversy regarding the role of the upper canaliculus in tear drainage. Saunders *et al.* suggested that injuries to the lower canaliculus were associated with a higher frequency of postoperative symptoms than if only the upper canaliculus was involved.⁸ Walter also observed that none of the 18 patients complained of epiphora after repair of the lower canaliculus.⁹ Werb once commented that the conservation of the inferior canaliculus is for tear drainage, and the superior canaliculus for the ophthalmologist.¹⁰ However, Jones *et al.*¹ and other authors^{11–13} have shown that there is significant individual variation in the respective drainage capability of each canaliculus, and in a significant proportion of patients the upper canaliculus serves an important role in tear drainage. These findings have led Linberg and Moore to state 'The only way to avoid symptomatic patients is to repair all canalicular lacerations'.¹⁴ There is almost an even split among our respondents towards monocanalicular repair (43% against 40%).

The use of magnification is very much dependent on the surgeon's preference, the extent of the injury and the ease of locating severed canaliculus. Ninety-two per cent of our respondents preferred to use some form of magnification.

The pigtail probe, which was originally described by Worst in 1962,¹⁵ had a sharp crochet hook end that was associated with a high incidence of failure and iatrogenic damage to the uninvolved canaliculus, and creation of false passageways^{2,7,8,16} that led to its gradual disuse. Its tarnished legacy (with an often quoted 10% or higher iatrogenic intact

canaliculus injury rate)⁸ was reflected by 57% of our respondents stating categorically they would never consider its use. More recently, there have been attempts to rehabilitate the instrument through various modifications. Jordan *et al.* described the use of a more atraumatic round-tipped, eyed pigtail probe in 33 of their patients with a 97% success rate.¹⁷ McLeish *et al.* used the round-tipped pigtail probe and they suggested further minimizing the risk of collateral damage with the simultaneous use of the Crawford intubation stent as a guide to direct the passage of the probe through the normal canaliculus.¹⁸

There were a myriad of other methods described to facilitate the location of the severed medial end of the canaliculus with generally a low incidence of side-effects but their very proliferation indicated none was fool-proof. Most of these methods were mentioned by our respondents. These included injection of various substances through the intact canaliculus while occluding the lacrimal sac, or in the case of bicanalicular injury these may be injected directly into the lacrimal sac to observe reflux. The substances used include air under a water or saline pool (bubble test),¹⁹ boiled milk,^{20–22} steroid-antibiotic suspension,²³ methylene blue,^{21,24} sodium hyaluronate²⁵ or fluorescein.²⁶ Another study described the use of sympathomimetic drops to blanch pericanalicular tissues or cause retraction of surrounding muscle fibres to allow easier identification of the cut end.²⁷ Indeed, simply delaying the primary repair may allow the lacerated end to become more visible.²⁸

Vicryl was the most popular suture material of choice for both pericanalicular tissues (6/0) and canalicular mucosal anastomosis wall repair (8/0). There has been a multitude of materials historically used for canalicular stents. These include natural organic, metal-metal composite or synthetic stents.⁵ Silicone has gained popularity as the ideal stent as it is inert, soft and pliable, thus avoiding trauma to the healing tissues. Its stability and inert nature allow the stent to be remained *in situ* for a long period. The methods of stent placement that were popular among our respondents were either the simple monocalicular placement of the Mini-Monoka, or the bicanalicular-nasal stents (Crawford or Ritleng). The former has the advantage of ease of placement and retrieval, with no risk of iatrogenic damage to the uninjured canaliculus. The disadvantage is that it is more easily lost. The advantage of the bicanalicular stents is better stent retainment, although nasal retrieval is required and there is a small risk of collateral damage.

The timing of stent removal would be influenced by the materials used and types of fixation. Silicone tubes are generally better tolerated and hence can be left in place for longer periods of time. Kersten and Kulwin left the silicone stents in place for 3 months in their patients with 100% patency²⁹ but 4% had postoperative symptomatic epiphora. Jordan *et al.* described the use of doughnut (bicanalicular-annular silicone stent) method together with the use of round-tipped, eyed pigtail probe.¹⁷ They left the silicone stent in place for 12 months with good results. Opinions

Table 2. Level of agreement (in descending order) of practices in the management of lacrimal canalicular injury

| Practice | Level of agreement (%) |
|---|------------------------|
| Bubble test or fluorescein to locate medial cut end | 96 |
| Use of magnification | 92 |
| Use of stents | 85 |
| Undertaking dacryorhinostomy 3–12 months if repair failed | 76 |
| Using vicryl or dexion suture | >70 |
| Leaving stent <i>in situ</i> between 6 weeks and 3 months | 70 |
| Prophylactic antibiotics | 53 |
| Stent replacement if lost within the first week after surgery | 52 |
| Using a pigtail probe | 42 |
| Always repairing a monocalicular injury | 40 |

divided as to whether stent should be replaced if lost within the first postoperative week. This decision would have to be based on preoperative and intraoperative findings, as well as the method used for the repair. However, as mentioned above, there is evidence to suggest that stent should be left in place for a long enough period of time in order for adequate mucosal healing to take place, minimizing the risk of ductal stenosis. In an animal study, it was found that silicone intubation was necessary to re-establish patency of the canaliculus and that silicone intubation with and intubation without mucosal anastomosis were equally efficacious in restoring canalicular patency. The optimum time for tube removal in the study was found to be best at 12 weeks.³⁰ Immediate canaliculo-dacryorhinostomy was not favoured by our cohort and in cases of monocalicular injury. Seventy-six per cent of our respondents would cautiously wait for at least 3 months before considering lacrimal drainage surgery.

There was almost an even split among our cohort regarding antibiotic prophylaxis. Undoubtedly, the decision would be influenced by the mechanism of injury. In four different studies examining the various aetiologies of canalicular laceration, assault or fighting seemed to be one of most common causes.^{8,16,31,32}

Indeed the type of operative procedure appears to have no significant effect on the postoperative patency of the injured canaliculus, so long as the principles of surgery are adhered to. Despite a high level of agreement among certain aspects of lacrimal canalicular injury management as shown in Table 2, our national survey shows that the management of such injuries varies widely among the consultant oculo-plastic surgeons in the UK.

ACKNOWLEDGEMENTS

The authors would like to thank all those who responded to our questionnaire; without their participation, this study would not have been possible.

REFERENCES

1. Jones LT, Marquis MM, Vincent NJ. Lacrimal function. *Am J Ophthalmol* 1972; **73**: 658–9.
2. Anderson RL, Edwards JJ. Indications, complications and results with silicone stents. *Ophthalmology* 1972; **86**: 1474–87.
3. Welham RAN. The immediate management of injuries to the lacrimal drainage apparatus. *Trans Ophthalmol Soc UK* 1982; **102**: 216–17.
4. Heinze JW. Microsurgery and the lacrimal system. *Adv Ophthalmol* 1978; **37**: 87–96.
5. Reifler DM. Management of canalicular laceration. *Surv Ophthalmol* 1991; **36**: 113–31.
6. Kennedy RH, May J, Dailey J, Flanagan JC. Canalicular laceration. *Ophthalm Plast Reconstr Surg* 1990; **6**: 46–53.
7. Canavan YM, Archer DB. Long term review of injuries to the lacrimal drainage apparatus. *Trans Ophthalmol Soc UK* 1979; **99**: 201–4.
8. Saunders DH, Shannon GM, Flanagan JC. The effectiveness of the pigtail probe method of repairing canalicular lacerations. *Ophthalmic Surg* 1978; **9**: 33–40.
9. Walter WL. The use of the pigtail probe for silicone intubation of the injured canaliculus. *Ophthalmic Surg* 1982; **13**: 488–92.
10. Werb A. Panel discussion on the lacrimal system. In: Smith B, Converse JM, Wood-Smith D, Obear MF, eds. *Plastic and Reconstructive Surgery of the Eye and Adnexa: Proceedings of the Second International Symposium*. St Louis, MO: CV Mosby, 1987; 182.
11. Crawford JS. Intubation of obstructions in the lacrimal system. *Can J Ophthalmol* 1977; **12**: 289–92.
12. Denffer HV, Dressler J, Pabst HW. Lacrimal dacryoscintigraphy. *Semin Nucl Med* 1984; **14**: 8–15.
13. Lemp MA, Weiler HH. How do tears exit? *Invest Ophthalmol Vis Sci* 1983; **24**: 619–22.
14. Linberg JV, Moore CA. Symptoms of canalicular obstruction. *Ophthalmology* 1988; **95**: 1077–9.
15. Worst JG. Method for reconstructing torn lacrimal canaliculus. *Am J Ophthalmol* 1962; **53**: 520–2.
16. Hing SJ. A retrospective study of lacrimal canalicular injuries in Auckland. *Trans Ophthalmol Soc NZ* 1984; **36**: 72–3.
17. Jordan D, Nerad JA, Tse DT. The pigtail probe, revisited. *Ophthalmology* 1990; **97**: 512–19.
18. McLeish WM, Bowman B, Anderson RL. The pigtail probe protected by Silicone Intubation: a combined approach to canalicular reconstruction. *Ophthalmic Surg* 1992; **23**: 281–3.
19. Loff HJ, Wobig JL, Dailey RA. The bubble test: an atraumatic method for canalicular laceration repair. *Ophthalm Plast Reconstr Surg* 1996; **12**: 61–4.
20. Fox SA. *Ophthalmic Plastic Surgery*, 5 edn. New York: Grune & Stratton, 1976; 584–607.
21. Mustardé JC. *Repair and Reconstruction in the Orbital Region*, 2 edn. Edinburgh: Churchill Livingstone, 1980; 195–203.
22. Ramocki JM, Nesi FA, Spoor TC. Management of injuries to the ocular adnexa. In: Spoor TC, Nesi FA, eds. *Management of Ocular, Orbital, and Adnexal Trauma*. New York: Raven Press, 1988; 381–426.
23. Katowitz JA. Lacrimal drainage surgery. In: Duane T, Jacger EA, eds. *Clinical Ophthalmology, Ophthalmic Surgery*, Vol. 5. Philadelphia, PA: Harper & Row, 1983; 1–32.
24. Zolli CL. Microsurgical repair of lacrimal canaliculus in medical canthal trauma. In: Hornblass A, ed. *Oculoplastic, Orbital and Reconstructive Surgery, Eyelids*, Vol. 1. Baltimore, MD: Williams & Wilkins, 1988; 426–32.
25. Vila-Coro AA, Vila-Coro AA. Hyaluronate facilitates passage of lacrimal probes for repair of lacerated canaliculi. *Arch Ophthalmol* 1988; **106**: 579.
26. Wobig JL. Treatment of canalicular diseases and injuries. In: Silver B, ed. *Ophthalmic Plastic Surgery*. Rochester, MN: American Academy of Ophthalmology and Otolaryngology, 1977; 184–9.
27. Baylis HI, Axelrod R. Repair of the lacerated canaliculus. *Ophthalmology* 1978; **85**: 1271–6.
28. Bennett JE. The lacrimal drainage system. In: Duane TD, ed. *Clinical Ophthalmology, Ophthalmic Surgery*, Vol. 5. Hagerstown, MD: Harper & Row, 1976; 1–8.
29. Kersten RC, Kulwin DR. 'One-stitch' canalicular repair. *Ophthalmology* 1996; **103**: 785–90.
30. Conlon MR, Smith KD, Cadera W, Shum D, Allen LH. An animal model studying reconstruction techniques and histopathological changes in repair of canalicular lacerations. *Can J Ophthalmol* 1994; **29**: 3–8.
31. Billson FA, Taylor HR, Hoyt CS. Trauma to the lacrimal system in children. *Am J Ophthalmol* 1978; **86**: 828–33.
32. Hawes MJ, Segrest DR. Effectiveness of bicanalicular silicone intubation in the repair of canalicular lacerations. *Ophthalm Plast Reconstr Surg* 1985; **1**: 185–90.

5

6