Evidence-based practice in acute ophthalmology

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Abstract

Aim To study the overall level of evidence-based practice in an accident and emergency eye unit in the UK and evaluate the extent of evidence-based practice by ophthalmologists and nurse practitioners (NPs).

Methods The case notes of all new patients attending our accident and emergency department for a period of 1 week were reviewed prospectively. For each case, the diagnosis at presentation and its intervention was ascertained. A literature search using Medline and Cochrane library was performed to assess the level of evidence provided for each diagnosis–intervention pair. Each diagnosis–intervention pair was evaluated and graded to assess the best level of evidence provided.

Results A total of 474 new patients attended the eye casualty during the study period. No diagnosis was made in 27 cases and they were excluded from the analysis. Out of 447 patients, 308 (68.9%) cases were managed by NPs and 139 (31.1%) by doctors. A total of 294 (65.8%) patient interventions were based on evidence from systematic reviews, meta-analysis and randomised-controlled trials, of which 223 were managed by NPs and 71 by ophthalmologists. This difference was statistically significant with $P < 0.001$. One hundred and seven (23.9%) interventions were supported by evidence from prospective and retrospective trials.

Conclusion This study demonstrated that two-thirds of interventions were based on the highest level of evidence and was comparable to studies performed in other specialities. It also highlights the advanced role of trained NPs in acute ophthalmology.

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Introduction

Evidence-based medicine is the 'conscientious, explicit, and judicious use of current best evidence in making decisions about care of individual patients'.¹ The philosophical origin of evidence-based medicine extends back to mid-19th century and earlier,¹ but has gained considerable momentum only in the last decade. There is an increasing demand that medical practice should no longer be based on hypothetical thinking but rather on scientific validation. The Oxford centre for evidence-based medicine has developed a grading scheme depending on the quality of scientific evidence. According to it, depending on the validity of evidence, the systematic review of randomised-controlled trials and randomised-controlled trials form the highest level of evidence, that is, level 1, and case reports, and expert opinion form the lowest level, that is, levels 4 and 5, respectively.²

In 1991, it was suggested that only 15% of medical interventions are supported by solid scientific evidence.³ Since then various studies have been conducted in different specialities to refute this claim. Ellis *et al*⁴ studied whether in-patient general medicine is evidence based. In their retrospective study they found that 82% of patients received evidence-based interventions. Jemec *et al*⁵ found that three-quarters of dermatologic outpatient therapy is based on scientific evidence and Howes *et al*⁶ concluded that in-patient general surgery is evidence based, but the proportion of surgical treatments supported by randomised-controlled trials is much smaller than that found in general medicine. In 2003, a clinical audit was conducted at Hong Kong eye hospital to determine the proportion of evidence-based interventions in their emergency unit. The audit found that 42.9% of interventions were based on evidence from systematic reviews, meta-analysis, or randomised-controlled trials.⁷

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Wolverhampton and Midland Counties Eye Infirmary is a large district general hospital serving population of approximately 1 million. Average annual attendance for the ophthalmic Accident and Emergency department is 24–25 000. A triage system was introduced in 1998 to tackle the ever increasing workload. According to this, the patients are prioritised depending on the acuteness and severity of the presenting condition. All grades of staff including Ophthalmic trained nurse practitioners (NPs), junior and senior Ophthalmologists are involved in patient care. Ophthalmic trained NPs on an average diagnose and manage about two-third of the cases.

We conducted a prospective study to evaluate the proportion of ophthalmic interventions that are evidence based in an ophthalmic accident and emergency setting. To the best of our knowledge, there has been no similar study conducted in acute ophthalmology in the UK.

Methods

In July 2003, for a period of 1 week, the charts of all the new patients attending our accident and emergency department were prospectively retrieved. As this was a prospective, observational study in consecutive patients with no major exclusion criteria no ethical approval was sought. To avoid bias, the NPs and the doctors on duty during the time were kept unaware of the study and the three investigators did not have any duty in the accident and emergency department during this time period. Charts of all the new attendants were collected at the end of the day and data regarding patients' characteristics and the examining medical or nursing staff was taken in a standard proforma. For each new case, a primary diagnosis at presentation and primary intervention was identified individually by each investigator. Primary diagnosis was defined as the condition with which patient presented to the accident and emergency department and primary intervention was the single most relevant intervention for its management. The cases in which no diagnosis was derived were excluded from the analysis. A corresponding literature search for each diagnosis–intervention pair using Medline from 1966 to October 2004 and Cochrane library was carried out to assess the level of evidence provided. The search was limited to English language. The evidence obtained was verified by two investigators separately. In case of discrepancy, a common consensus was reached following discussion. The evidence obtained was then graded into five hierarchical categories as described by Kingston *et al*⁸ (Table 1). Accordingly, systematic review was graded as level 1 evidence and retrospective study as level 5 evidence. This methodology was identical to the study by Lai *et al*.⁷ Unlike the levels of evidence described by Oxford centre of evidence-based medicine, case reports

Table 1 Levels of evidence according to Kingston *et al*⁸ (*n* = 447)

Level	Study design	No. of patients (%)
1	Systematic review	80 (17.9)
2	Meta-analysis	33 (7.4)
3	Randomised-controlled trial	181 (40.5)
4	Prospective study	65 (14.5)
5	Retrospective study	42 (9.4)
None	No evidence or evidence opposed the intervention	46 (10.3)

and expert opinion were not considered in this hierarchy of evidence.

The number (%) of patients managed by ophthalmologists and ophthalmic NPs were derived and the number (%) of patient intervention in each group supported by evidence levels 1, 2, and 3 were calculated. Percentages were calculated using the number of patients studied as denominator. χ^2 test was performed to see the difference between the proportion of interventions based on highest level of evidence between the two groups (Ophthalmic trained NPs and ophthalmologists).

Results

A total of 474 patients attended our accident and emergency department during the study period. A total of 27 patients were excluded from the analysis as no diagnosis was derived. Out of 447 patients, 278 (58.6%) were male and 196 (41.4%) were female. The age ranged from 4 weeks to 93 years. A total of 308 (68.9%) patients were managed by ophthalmic trained NPs and 139 (31.1%) by junior and senior ophthalmologists.

Altogether 80 primary diagnosis–intervention pairs were made. Figure 1 shows the number of patient interventions supported by each level of evidence and individual bar in each category showing whether they were managed by a NP, or an ophthalmologist.

A total of 294 (65.8%) of patient interventions and 32 diagnosis–intervention pairs were based on evidence from systematic reviews, meta-analysis, and randomised-controlled trials (Tables 2 and 3). Out of 308 patients managed by NPs, 223 (72.4%) interventions were based on evidence levels 1, 2, and 3 and out of 139 patients managed by ophthalmologists, 71 (51.1%) interventions were based on evidence levels 1, 2, and 3. This difference was statistically significant with $P < 0.001$. Out of 32 diagnosis–intervention pairs based on highest level of evidence, four were exclusively managed by NPs and the remaining by ophthalmologists. A total of 107 (23.9%) patient interventions were based on prospective and retrospective trials (Tables 4 and 5). Overall, 89.7% of patient interventions were based on some scientific evidence.

Figure 1 Number of patient interventions based on each level of evidence (Kingston *et al.*,⁸ $n = 447$).

Table 2 Interventions based on systematic reviews or meta-analysis ($n = 113$)

Primary diagnosis	Primary intervention	Total no. of patients	No. of patients managed by NPs	No. of patients managed by doctors	Reference
Presumed bacterial conjunctivitis	Topical broad spectrum antibiotics	69	65	4	⁹
Corneal abrasion	Topical antibiotics, no patching	32	32	0	¹⁰
Dendritic ulcer	Topical acyclovir	6	0	6	¹¹
Senile cataract	Phacoemulsification cataract extraction	2	0	2	¹²
Asymptomatic, round retinal hole	No treatment	1	0	1	¹³
Asymptomatic lattice degeneration	No treatment	1	0	1	¹³
Neovascular glaucoma sec to CRVO	Maximum medical therapy + argon laser panretinal photocoagulation	1	0	1	¹⁴
Choroidal melanoma	Ruthenium plaque	1	0	1	¹⁵

A total of 24 (5.4%) patient interventions were against the evidence and there was no evidence for 22 (4.9%) interventions (Tables 6 and 7). Thirty two (10.4%) of patients managed by NPs were against evidence or had no evidence as opposed to 14 (10.1%) managed by doctors.

Discussion

Evidence-based medicine has become a topic of debate in all fields of medicine. In this study, we surveyed the extent to which the activity of our accident and emergency department is evidence based.

This study demonstrated overall 90% of interventions were based on some scientific evidence as compared to 77% evidence-based interventions in the study by Lai *et al.*⁷ Our results were also comparable to similar studies conducted in other specialities.^{4-6,69} We found that two-thirds of interventions were based on the highest level of evidence and that routine practice in our unit is

supported by good quality of evidence. Using similar classification, Kingston *et al.*,⁸ in a retrospective audit, found that 45% of interventions in surgical practice were based on randomised-controlled trials or better evidence. Lai *et al.*,⁷ used same classification in a prospective audit and found that 42.9% of their patient intervention in ophthalmology was based on evidence from randomised-controlled trial or better. Our results were better than their study because of a different case mix and a guideline-based practice among NPs. Also, about half of the cases were common and simple, which were supported by a higher level of evidence. Moreover, historically Wolverhampton and Midland counties Eye Infirmary accident and emergency department provides an open, walk-in access for secondary and tertiary care to a large catchment area and hence there is a higher proportion of common and simple conditions presenting to us. Ellis *et al.*⁴ used a different classification and reported that 53% of interventions in general medicine were based on randomised-controlled trials. Jemec *et al.*,⁵

Table 3 Interventions based on randomised controlled trials ($n = 181$)

Primary diagnosis	Primary intervention	Total no. of patients	No. of patients managed by NPs	No. of patients managed by doctors	Reference
External eye foreign body	Removal of foreign body, broad-spectrum antibiotics, no patching	84	84	0	16
Anterior uveitis	Topical steroids	27	0	27	17
Dry eyes (moderate)	Viscotears	28	28	0	18
Allergic conjunctivitis	G Opticrom	5	2	3	19
Presumed viral conjunctivitis	Tear supplements	4	4	0	20
Herpes zoster ophthalmicus	Oral acyclovir	4	0	4	21
Proliferative diabetic retinopathy	Argon laser panretinal photocoagulation	3	0	3	22
Severe keratoconjunctivitis sicca	G celluvisc	3	0	3	23
Dry eyes (mild)	G hypotears	4	4	0	24
Allergic rhinoconjunctivitis	Oral antihistamine	3	3	0	25
Marginal keratitis	Topical steroid-antibiotic	2	0	2	26
Corneal ulcer	Corneal scrapes + topical ofloxacin	2	0	2	27
Herpes zoster keratouveitis	Occ acyclovir + topical steroid	1	0	1	28
Uveitis (steroid responder)	G vexol	1	0	1	29
Allergic conjunctivitis	G Otrivine-antistin	1	1	0	30
Allergic conjunctivitis	G Optilast	1	0	1	31
Congenital blocked nasolacrimal duct	Topical antibiotic + hydrostatic sac massage	1	0	1	32
Blepharitis	Topical maxitrol	1	0	1	33
Blepharitis	Topical ofloxacin	1	0	1	34
Ocular hypertension	Investigate	1	0	1	35
Optic neuritis	MRI scan	1	0	1	36
Retinal detachment	Pars plana vitrectomy + encircling + SF6	1	0	1	37
Exudative AMD	Fundus fluorescein angiography	1	0	1	38
Large choroidal melanoma	Enucleation	1	0	1	39

Table 4 Interventions based on prospective case series ($n = 65$)

Primary diagnosis	Primary intervention	Total no. of patients	No. of patients managed by NPs	No. of patients managed by doctors	Reference
Meibomian cyst	Topical antibiotics + warm compresses	23	23	0	40
Posterior vitreous detachment	Full peripheral retinal examination + RD warning + no follow-up	15	0	15	41
Marginal keratitis	Topical antibiotics	5	3	2	42
Corneal infiltrates in contact lens wearers	Topical antibiotics	4	4	0	43
Blepharitis	Lid hygiene	3	3	0	44
Corneal ulcer	Topical antibiotics	3	2	1	42
Meibomian cyst	Incision and curettage	3	3	0	40
Loose corneal sutures	Removal of sutures + topical antibiotics	2	0	2	45
Intolerance to glaucoma medication	Discontinue medication	3	0	3	46
Corneal decompensation	Topical hypertonic saline	1	0	1	47
Filamentary keratitis	Debridement of corneal filaments	1	0	1	48
Conjunctival reaction to vicryl, recent squint surgery	Topical steroids	1	0	1	49
Involitional entropion	Lateral canthal tendon strip	1	0	1	50

Table 5 Interventions based on retrospective case series ($n = 42$)

Primary diagnosis	Primary intervention	Total no. of patients	No. of patients managed by NPs	No. of patients managed by doctors	Reference
Chemical conjunctivitis	Irrigation + topical antibiotics	8	6	2	51
Posterior vitreous detachment	Full peripheral retinal examination + RD warning + subsequent assessment	5	0	5	52
Episcleritis	Topical steroids	5	0	5	53
Recurrent corneal erosion	Viscotears + lacrilube $\times 6/12$	4	4	0	54
Chemical conjunctivitis	Topical antibiotics	4	4	0	51
Preseptal cellulites	Oral antibiotics	2	0	2	55
Wound abscess following lid surgery	Removal of infected suture + antibiotic	1	0	1	56
Epscleritis	Oral anti-inflammatory	1	1	0	53
Acute dacryocystitis	Oral antibiotics + incision and drainage	1	0	1	57
Acute dacryocystitis	Oral antibiotics	1	0	1	58
Secondary glaucoma	Max medical therapy + topical steroids	1	0	1	59
HSV Keratitis + sec raised IOP	Occ Zovirax + g timolol	1	0	1	60
Blebitis	Topical antibiotics + steroids	1	0	1	61
Sixth nerve palsy	Fresnel prism	1	0	1	62
Vertical diplopia (thyroid eye disease)	Fresnel prism	1	0	1	62
Third nerve palsy in infant	Neurological evaluation + MRI scan	1	0	1	63
Horseshoe retinal tear	Argon laser retinopexy	1	0	1	64
Introcular foreign body	Removal of IOFB + vitrectomy	1	0	1	65
Nonarteritic anterior ischaemic optic neuropathy	Oral aspirin	1	0	1	66
Amaurosis fugax	Carotid doppler	1	0	1	67

Table 6 Interventions against evidence ($n = 24$)

Primary diagnosis	Primary intervention	Total no. of patients	No. of patients managed by NPs	No. of patients managed by doctors	Reference
Presumed viral conjunctivitis	Topical antibiotics	8	8	0	20
Rust ring	Removal of rust with hypodermic needle	7	7	0	68
Corneal abrasion	Topical antibiotic + patching	6	6	0	10
Herpes zoster ophthalmicus	Occ acyclovir	1	0	1	21
Presumed viral conjunctivitis, PEH: corneal graft	Topical steroids	1	0	1	20
Blepharitis	Topical steroids	1	0	1	33

in a retrospective study, reported that 38% of dermatologic therapeutic decisions were based on randomised-controlled trials. Myles *et al*⁷¹ prospectively surveyed anaesthetic interventions in routine practice and found that 32% were supported by randomised-controlled trials.

Our study also highlighted the success of advanced role of trained NPs in acute ophthalmology. In 1998, Banerjee *et al*⁷⁰ carried out a study to assess the

diagnostic and management skills of eye-dedicated NPs. They found 100% concordance between NPs and supervising doctor in diagnosis and 96% concordance between the two in management of those cases. In our accident and emergency department, NPs routinely treat and discharge cases like conjunctivitis, corneal abrasion, recurrent corneal erosion, dry eyes, external eye foreign body, meibomian cyst, etc. These conditions form the major bulk of acute ophthalmology. There are guidelines

Table 7 Interventions in which no evidence was found ($n = 22$)

<i>Primary diagnosis</i>	<i>Primary intervention</i>	<i>Total no. of patients</i>	<i>No. of patients managed by NPs</i>	<i>No. of patients managed by doctors</i>
Traumatic conjunctival laceration	Topical antibiotic	7	0	7
Traumatic subconjunctival haemorrhage	Topical antibiotic	3	3	0
Acute nonarteritic central retinal artery occlusion	Ocular massage, CO ₂ rebreathing, IV Diamox, tab aspirin, cardiovascular investigation	2	0	2
Allergy to cosmetic product	Avoid allergen	2	2	0
Episcleritis	G acular	2	0	2
Herpes zoster ophthalmicus	Occ chloramphenicol	1	1	0
Dendritic ulcer	Occ chloramphenicol	1	1	0
Filamentary keratitis	Occ chloramphenicol	1	1	0
Traumatic subconjunctival haemorrhage	G viscotears	1	1	0
Inflamed pingecula	Topical antibiotic	1	1	0
Conjunctival retention cyst	Topical lubricant	1	1	0

and protocols drawn up for management of conditions like conjunctivitis, corneal abrasion, and external eye foreign body from evidence provided from systematic review and meta-analysis of various studies. There is also a care pathway for conjunctivitis in practice which provides an evidence-based approach for management of acute bacterial, viral or allergic conjunctivitis. Hence, the higher proportion of interventions based on levels 1, 2, and 3 evidence among the patients managed by NPs.

This study shows that the number of patient interventions based on highest level of evidence was higher in NPs' group than ophthalmologists. As mentioned earlier, NPs were involved in managing common and relatively simpler conditions like external eye foreign body, presumed bacterial conjunctivitis, corneal abrasion, and dry eyes. There were 218 patients with these four diagnoses that formed 70.8% of NPs practice and four out of 32 diagnosis-intervention pairs based on levels 1, 2, and 3 evidence. This is also based on our local protocol which encourages NPs to manage such conditions that are simpler to manage and are backed by the highest level of evidence.

Tables 2–7 show the wide range of ophthalmic emergencies that are presented in our casualty department during the study period. As mentioned earlier, all common and routine cases are routinely dealt with by trained NPs and the rest by the ophthalmologists. Some of the cases managed by the ophthalmologists tend to be complex thus explaining the relatively lower percentage of patients managed on higher levels of evidence by the ophthalmologists as compared to the NPs. In all, 51.1% of interventions by ophthalmologists were based on the highest level of evidence, that is, systematic review, meta-analysis, and

randomised-controlled trials, which was comparable with other studies.^{4–8,69}

Critics of evidence-based medicine argue that it relies heavily on randomised-controlled trials. There are some interventions that can never be supported by randomised-controlled trials. Conditions such as nonarteritic central retinal artery occlusion are rare and it is difficult to set up a randomised-controlled trial to prove the benefit of a particular method of treatment. However, as the authors of the Cochrane review suggest, as the sight loss can be devastating, it is understandable to try simple noninvasive treatments so that both parties can feel that 'something was done'.⁷¹ For the management of conditions such as chemical conjunctivitis, preseptal cellulitis, acute dacryocystitis, etc, natural history and long-term follow-up studies provide valid evidence and it would be difficult to carry out randomised-controlled trials. However, there is a need for stronger evidence to manage conditions like posterior vitreous detachment, marginal keratitis, recurrent corneal erosion, etc.

There are certain limitations to our study which need to be addressed. We included any randomised-controlled trial as a higher level of evidence to any prospective or retrospective study. An ill-designed randomised-controlled trial with short follow-up can give less valid evidence as compared to a long-term follow-up study. Owing to the large scale of our study, it was not possible to look at the validity of individual studies. Another shortcoming was that we searched only two databases, that is, Medline and Cochrane database and our search was limited to English language. Hence, there is a possibility that we might have missed studies cited on other database and also published in other language.

In summary, our study demonstrated that a majority of our practice in acute ophthalmology is based on scientific evidence. This study has also highlighted potential areas for future research.

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