SCIENTIFIC REPORT

Floppy iris behaviour during cataract surgery: associations and variations

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Aim: To assess the association of floppy iris behaviour during cataract surgery with use of α-1-antagonists and diabetes mellitus.

Methods: 1842 eyes of 1786 patients undergoing phacohoemulsification surgery were prospectively enrolled. The use of commonly prescribed α-1-antagonists and the presence or absence of diabetes mellitus were noted. The occurrence of any of the features of the intraoperative floppy iris syndrome (IFIS) was noted by surgeons blinded to the patient's history.

Results: 57% of patients receiving tamsulosin showed features of IFIS compared with 1% of the non-tamsulosin group ($p<0.001$). Of these, more than half the patients manifested the syndrome in an incomplete form. Only 1 of the 51 patients receiving other α-1-antagonists had IFIS. Diabetes was also not associated with IFIS ($p=1$).

Conclusions: Tamsulosin is significantly associated with floppy iris behaviour during cataract surgery. But not all of these patients will necessarily show all or any features of IFIS. The floppy iris syndrome is likely to represent a continuum of severity. Various undefined factors, diabetes not being one of them, may have a contributory role. Non-selective α-1-antagonists are unlikely to be associated with IFIS.

The intraoperative floppy iris syndrome (IFIS) consists of: (1) a floppy iris that undulates in response to ordinary fluid currents, (2) repeated prolapse of the iris and (3) progressive intraoperative constriction of the pupil.[1] Two studies reporting this syndrome have associated it with the use of tamsulosin,[1 2] a sympathetic α-1 blocker used in the treatment of lower urinary tract symptoms (LUTS). Other α-1 blockers such as alfuzosin, doxazosin and terazosin may also be associated with IFIS, although objective evidence for this is lacking.[3 4] Other clinical covariates such as age, diabetes and other systemic drugs may also influence intraoperative iris behaviour.[5] This prospective study was aimed at assessing the association of IFIS with all commonly prescribed α-1 blockers. It also assessed the contribution of diabetes to intraoperative iris behaviour.

METHODS

We enrolled all patients undergoing phacoemulsification at Queen Margaret Hospital, Dunfermline, UK, from April 2005 to February 2006 and at Princess Alexandra Eye Pavilion, Edinburgh, UK, from October 2005 to February 2006. Data were collected on specific parameters preoperatively using a standard data sheet (see box).

The patients' pupils were dilated using a standard protocol of 1% cyclopentolate and 2.5% phenylephrine drops, supplemented with a repeat instillation before surgery if the pupil was inadequately dilated.

All operating surgeons were blinded to the patients' drug histories and were asked to report the occurrence of any features of IFIS (box). These intraoperative findings were noted immediately after the surgery.

The data were collated on a Microsoft Excel spread sheet. We considered IFIS as encompassing a continuum of features. We defined two forms of the syndrome—complete and incomplete. Complete IFIS was defined as a condition having all three features. Incomplete IFIS was defined as the presence of a floppy iris with or without any one of the two other features. The data were statistically analysed using SPSS V.10.

RESULTS

Data were prospectively obtained from 1842 eyes of 1786 patients, 46% of whom were male. In all, 72 (4%) patients were receiving α-1 blockers, most of whom were receiving doxazosin (table 1). Also, 1.2% of the study population were receiving tamsulosin. A total of 11 (0.6%) eyes of 11 patients had complete IFIS and 18 (1%) eyes of 18 patients had incomplete IFIS.

Tamsulosin

Table 2 shows the patients with IFIS in the tamsulosin and non-tamsulosin groups. These groups were found to be

Box: Information obtained during data collection at the preoperative and inraoperative stage

- Preoperative data collection: parameters noted
  - Age
  - Sex
  - Current or previous treatment with tamsulosin, prazosin, doxazosin, terazosin or alfuzosin
  - Duration of treatment
  - Presence or absence of diabetes mellitus
- Intraoperative data collection: features noted
  - Any occurrence of unusual billowing or floppiness of the iris
  - A pupil size of approximately 5 mm less at the start or at any time during the surgery
  - Any occurrence of iris prolapse
  - Any significant intraoperative complication (eg, posterior capsule rupture)
  - Any surgical/intraoperative factors that may have contributed to any of the above (eg, poor incision construction)

Abbreviations: IFIS, intraoperative floppy iris syndrome; LUTS, lower urinary tract symptoms

Table 1 Distribution of the patients taking α-antagonists

α- antagonist	Number of patients (number of eyes)	Men	Women
Tamsulosin	21 (21)	20	1
Doxazosin	48 (50)	18	30
Alfuzosin	2 (2)	2	0
Terazosin	1 (1)	1	0

age-matched. In all, 12 (57%) patients receiving tamsulosin had complete or incomplete IFIS. None of them had diabetes. The association of tamsulosin with IFIS was found to be highly significant when comparing complete IFIS between the two groups ($p<0.001$, Fisher's exact test). This was also true when considering IFIS as a continuum and comparing the trend for increasing number of IFIS features between the two groups ($p<0.001$, Fisher's exact test).

The mean duration of tamsulosin treatment in patients with IFIS was 26 months and in those with no signs of IFIS 19.7 months. This was not significant ($p = 0.156$, Mann–Whitney U test).

Other α-blockers

In the non-tamsulosin group, the five patients with complete IFIS had never received any α-blockers. Of the patients with incomplete IFIS in this group, one patient was receiving doxazosin. None of the other patients receiving doxazosin or other α-blockers had any intraoperative problems. A comparison of the 50 eyes of patients receiving doxazosin with the rest of the eyes showed no significant difference in the occurrence of IFIS ($p = 0.507$, Fisher's exact test).

Diabetes

A total of 255 (13.8%) eyes of 247 patients with diabetes underwent surgery (table 3) One of these had complete IFIS and two had incomplete IFIS—small pupils with a floppy iris. They were not receiving any α-blockers. One patient with diabetes was receiving tamsulosin and seven doxazosin. None of them had any features of IFIS. Diabetes was not found to be associated with the floppy iris syndrome ($p = 1$, Fisher's exact test).

Surgical complications

One patient with complete IFIS had a posterior capsular rupture with vitreous loss. His best-corrected visual acuity at eight weeks postoperatively was 6/9. None of the patients with incomplete IFIS had any significant intraoperative complications.

Table 2 Comparison of intraoperative floppy iris syndrome between the tamsulosin and non-tamsulosin groups ($p<0.001$; Fisher's exact test)

	Complete IFIS	Incomplete IFIS	No IFIS	Total
Receiving tamsulosin	6	6	9	21
Not receiving tamsulosin	5	12	1804	1821
Total	11	18	1813	1842

IFIS, intraoperative floppy iris syndrome.

Other ocular factors

Poor wound construction was noted as a factor in one of the patients with incomplete IFIS in the non-tamsulosin group. A retrospective study of the records showed that two patients with complete IFIS and one with incomplete IFIS had high myopia (axial lengths of 25.3, 26 and 26.4). One patient with incomplete IFIS had received pilocarpine previously. None of the patients had pseudoexfoliation, uveitis or previous vitrectomy.

DISCUSSION

Our study confirms the association of tamsulosin with IFIS. However, 43% of our patients receiving tamsulosin did not have any features of IFIS. The absence of IFIS has been previously noted in some patients receiving tamsulosin.[1] It is important to recognise that taking tamsulosin does not always result in IFIS. Duration of treatment, dose of tamsulosin, individual susceptibility to the drug, drug kinetics and coexisting ocular and systemic factors may all have some part to play in determining which of the patients receiving tamsulosin will develop IFIS.

The IFIS can have a range of severity of iris pathology.[6] Our results suggest the same. It is important to recognise an incomplete form of the syndrome that is also markedly associated with tamsulosin. We believe that incomplete IFIS can cause intraoperative problems similar to complete IFIS and requires similar management.

It has been suggested that discontinuing tamsulosin before cataract surgery may be helpful in preventing this syndrome.[1 7] In the absence of objective evidence, we do not recommend stopping tamsulosin before cataract surgery. The use of iris hooks should obviate any need to alter ongoing treatment. Further, intracameral phenylephrine has been shown to be effective in preventing IFIS in these patients.[8]

Some have suggested that IFIS may represent an effect of all α-1 blockers, albeit differing in its severity.[3 4] IFIS caused by alfuzosin has been reported.[9] Terazosin and doxazosin have also been anecdotally implicated.[10] Our study had 48 patients who were receiving doxazosin, and only one had incomplete IFIS. Our findings support the theory that high affinity of tamsulosin for α-1A receptors underlies the pathogenesis of IFIS.[1] Non-selective α-blockers are unlikely to be associated with IFIS.

In all, 14% of our patients had diabetes. Three of them had a small pupil, a feature well documented in diabetes.[11 12] We found no marked association between diabetes and IFIS. We found no evidence that it contributes to iris prolapse or a floppy iris.

Three of our patients with IFIS had high myopia. Surgical techniques used to counteract technical difficulties in cataract surgery in high myopia may contribute to the features of IFIS. A more posteriorly located corneal incision increases the chance of iris prolapse[13] but may aid phacoemulsification in high myopia. As we did not study this parameter prospectively, we cannot draw any marked conclusion regarding its significance.

One of the patients with incomplete IFIS was previously receiving pilocarpine, thus explaining the small pupil. One other patient with IFIS had a poorly constructed incision that could have led to iris prolapse.[13] However, there still remain several patients showing features of IFIS without any apparent explanation. Zuclopenthixol, an antipsychotic drug, has been associated with IFIS.[14] There are possibly other drugs and other ocular and systemic factors that may be similarly responsible.

The subjectivity of IFIS features has been highlighted previously.[15] A distinction may be made between poor preoperative pupillary dilatation and progressive pupillary constriction, both of which can occur in IFIS. In our study, we did not collect data on these two features separately. We arbitrarily chose 5 mm as the cut-off for the surgeon to report a

Table 3 Comparison of intraoperative floppy iris syndrome between patients with and without diabetes (p = 1; Fisher's exact test)

	Complete IFIS	Incomplete IFIS	No IFIS	Total
Diabetic	1	2	252	255
Not diabetic	10	16	1561	1587
Total	11	18	1813	1842

IFIS, intraoperative floppy iris syndrome.

pupil as inadequately dilated at any time during the surgery. In real situations, a surgeon would rarely attempt to measure the pupil size. This decreases the accuracy of reporting this feature. The detection of a floppy iris also remains a subjective assessment of the surgeon. Thus, there will always remain a measure of inaccuracy in the reporting of IFIS.

Our study has limitations. A large number of surgeons reported the IFIS cases. They may have varying techniques with respect to incision and phacoemulsification parameters. The subjectivity of IFIS features further complicates the issue. The criteria we used were more liberal than the original definition of IFIS. Our attempt was to quantify the features and obtain greater uniformity between our surgeons. Despite this, our study design may have led to under-reporting of IFIS. However, the results are highly significant in our resultant large group of patients.

Tamsulosin is the most commonly prescribed drug for LUTS. Yet, our study population had only 1.2% of patients receiving tamsulosin. This is in contrast with Chang and Campbell's figure of 2.5%. We collected this information prospectively, thereby reducing the chance of inaccurate data capture. Geographical variations in prescribing tamsulosin are documented in the USA.[16] We could not obtain similar data for the UK. The prevalence of LUTS in Scotland was found to be 18%, as opposed to 38% in the USA.[17] The prevalence of LUTS and the prescribing practice of general practitioners and urologists in a region will have a direct effect on its incidence of IFIS.

In conclusion, we believe that the floppy iris syndrome manifests as a continuum of severity. The pharmacological, ocular and systemic factors determining this need further investigation. Our study confirmed the association of tamsulosin use with IFIS, albeit in varying severity. However, doxazosin was not associated with this syndrome. In addition, we found diabetes to have no relationship with IFIS. Finally, we would like to emphasise that not all patients taking tamsulosin will necessarily have IFIS and not all patients with IFIS will necessarily be taking tamsulosin.

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