patients. On the other hand, their study showed that 36 in 240 preoperatively evaluated patients were managed for optimization before surgery, where reversal for anticoagulation was done for 18.7% patients. In twelve emergency hospital visits after surgery, one adverse event concerning anticoagulation was included.

Because of the minimum invasiveness of cataract surgery, a consensus that direct oral anticoagulants (DOACs) as well as vitamin K antagonists (VKAs) should be continued around the time of the procedure is steadily growing.[2] Clinically available blood-test monitoring cannot exactly measure the anticoagulation functions of DOACs.[3] This is also leading to a practical trend that DOACs can be used without the need for routine monitoring. We have recently surveyed 728 sequential clinical records of patients undergoing cataract surgery in our hospital after the approval of the institutional review board. We found that DOACs were prescribed to 12 patients, while only one patient with dabigatran was preoperatively evaluated for coagulopathy. Out of 42 patients taking warfarin 23 were not monitored with PT-INR. It is noteworthy that PT or APTT longer than normal limits in patients taking DOACs is a sign of the overdosing of DOACs.[3] PT-INR > 3 in patents with VKAs also points to abnormal bleeding.[2,4]

In this context, we think of a scenario where an anesthetic plan for outpatient cataract surgery was unexpectedly changed from local to general anesthesia. If this patient had taken DOACs several hours before the surgery, the risk of hematoma in the upper airway caused by laryngoscopy should be increased.[4] If the patient had renal dysfunction, this risk should be more increased.[3] If this patient had taken VKAs for several days before surgery, but not monitored with PT-INR, such risk should also be increased. Considering such a scenario, we recommend to monitor coagulation functions before cataract surgery when omitting the preoperative evaluation.

Conflict of interest

The authors declare no conflict of interest.

References

1 Alboim C, Kliemann RB, Soares LE, Ferreira MM, Polanczyk CA, Biolo A. The impact of preoperative evaluation on perioperative events in patients undergoing cataract surgery: a cohort study. *Eye (Lond)* 2016; **30**(12): 1614–1622.
2 Blum RA, Lindfield D. Direct oral anticoagulant drugs (DOAC). *J Cataract Refract Surg* 2016; **42**(1): 171–172.
3 Lippi G, Ardissino D, Quintavalla R, Cervellin G. Urgent monitoring of direct oral anticoagulants in patients with atrial fibrillation: a tentative approach based on routine laboratory tests. *J Thromb Thrombolysis* 2014; **38**(2): 269–274.
4 Karmacharya P, Pathak R, Ghimire S, Shrestha P, Ghimire S, Poudel DR *et al.* Upper airway hematoma secondary to warfarin therapy: a systematic review of reported cases. *N Am J Med Sci* 2015; **7**(11): 494–502.

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Sir,
Increased corneal densitometry as a subclinical corneal change associated with multiple myeloma

Multiple myeloma (MM) is a malignant plasma cell disorder of the bone marrow characterized by high levels of monoclonal serum protein and multiple organ involvement.[1] Corneal crystalline deposition is a rarely reported but known ocular manifestation of MM.[2] Recent reports have employed *in vivo* confocal microscopy (IVCM) to investigate MM-associated crystalline deposits.[3–5] However, the pathophysiology of this condition is not fully understood. To objectively quantify the MM-associated corneal changes in differing depths of the cornea, we obtained corneal densitometry data in MM patients using a Scheimpflug camera. A hypothesis for the pathogenesis of this condition is discussed.

Ten MM patients (5 males; 5 females; mean age, 70.1 ± 6.1 years) who were being routinely examined for their systemic disease were referred to the Ophthalmology department from the Hematology department. All patients underwent ophthalmologic screening, including slit-lamp and fundus examination. All eyes were deemed to be clear by slit-lamp examination without abnormal findings. Corneal densitometry measurements from the anterior, central, and posterior cornea within a 6-mm-diameter were attained using a Scheimpflug camera (Pentacam HR; Oculus GmbH). In total, 20 eyes from 10 MM patients were enrolled in this prospective case series. Ten eyes of 10 age-matched patients (mean age, 66.9 ± 6.5 years) undergoing routine examination before cataract surgery served as controls. Table 1 shows the densitometry values of the central 2-mm zone and of the surrounding 2- to 6-mm zone

Table 1 Subclinical corneal densitometry changes in anterior, central, and posterior corneal layers

Corneal densitometry (scatter units)	*Control group (10 eyes)*	*Multiple myeloma group (20 eyes)*
Anterior (0–2 mm)	23.43 ± 1.50	29.57 ± 2.43[a]
Anterior (2–6 mm)	22.42 ± 1.81	29.06 ± 3.51[a]
Central (0–2 mm)	14.68 ± 0.71	18.54 ± 2.40[a]
Central (2–6 mm)	14.26 ± 0.92	18.51 ± 2.23[a]
Posterior (0–2 mm)	12.93 ± 0.93	13.34 ± 1.55
Posterior (2–6 mm)	13.08 ± 1.28	14.07 ± 1.65

[a] $P < 0.001$ for control group *vs* multiple myeloma group.
Data are expressed as the mean ± SD.
0–2 mm: Central 2-mm diameter zone.
2–6 mm: The annulus extension zone (ie, the ring within a 2–6-mm diameter).

for both groups. MM eyes had significantly greater corneal densitometry values than control eyes in the anterior ($P<0.001$) and central ($P<0.001$) layers within a 6-mm diameter of the cornea. There was no significant difference in the posterior corneal layer between both groups.

To our knowledge, this is the first report of quantified corneal densitometry in MM. A recent study using IVCM[3] reported that MM patients without clinically evident corneal involvement show hyperreflective deposits in the epithelium and stroma as well as corneal structural changes, similar to observations in MM patients with clinically apparent corneal deposits.[4,5] Our results also demonstrate increased corneal densitometry in MM patients who were deemed to be clear by slit-lamp examination.

Crystals are thought to form due to the deposition of immunoglobulin light chain proteins and may diffuse from the tear film or aqueous fluid,[3] although the mechanism by which serum proteins in MM patients reach the cornea remains unclear. In the MM population of our study without clinically evident corneal involvement, increased corneal densitometry values were found in the anterior and central cornea. We presume that either of these may be the initial site of corneal immunoprotein deposition in MM patients, suggesting that serum proteins may diffuse from the tear film (anterior part) rather than from the aqueous fluid (posterior part). Future studies with a greater number of patients, varying degrees of corneal involvement, and comparative IVCM images may better our understanding of this pathophysiology.

In conclusion, corneal densitometry has the potential to non-invasively detect subclinical corneal alterations associated with MM and to further develop our understanding of MM-associated corneal deposits.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

All authors contributed to patient management and to the writing of the report. All authors approve of the final version of this manuscript.

References

1 Raab MS, Podar K, Breitkreutz I, Richardson PG, Anderson KC. Multiple myeloma. *Lancet* 2009; **374**: 324–339.
2 Milman T, Kao AA, Chu D, Gorski M, Steiner A, Simon CZ *et al.* Paraproteinemic keratopathy: the expanding diversity of clinical and pathologic manifestations. *Ophthalmology* 2015; **122**: 1748–1756.
3 Aragona P, Allegra A, Postorino EI, Rania L, Innao V, Wylegala E *et al.* Corneal structural changes in nonneoplastic and neoplastic monoclonal gammopathies. *Invest Ophthalmol Vis Sci* 2016; **57**: 2657–2665.
4 Micali A, Roszkowska AM, Postorino EI, Rania L, Aragona E, Wylegala E *et al.* Comparative confocal and histopathological study of corneal changes in multiple myeloma. *Cornea* 2017; **36**: 123–126.
5 Busch C, Koh S, Oie Y, Ichii M, Kanakura Y, Nishida K. *In vivo* confocal microscopy of multiple myeloma associated crystalline keratopathy. *Am J Hematol* 2017; **92**: 593–594.

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Sir,

A comparative study of adjustable and non-adjustable sutures in primary horizontal muscle surgery in children

We congratulate Kamal *et al*[1] on effecting a randomised controlled trial in paediatric strabismus, an area in which such evidence is lacking, but wish to raise some concerns about the techniques described.

The authors randomly allocate the cohort into two groups that cannot readily be compared. For example, the proportion of exotropes in the non-adjustable group is 40%, but only 23.3% in the adjustable group. Table 1 incorrectly states this percentage as 13.4%. There are no data on visual acuity, refraction or binocular status, which are important determinants of strabismus surgical outcomes. Describing motor outcomes in isolation may lead to erroneous conclusions. Patients with concurrent vertical and horizontal strabismus are included, but the vertical component ignored in analysis, which is not ideal as these patients have different responses to surgery.

The authors describe adjusting sutures 1–4 h post-operatively. This technique relies on orthoptic assessment of children recovering from general anaesthetic (GA) and who are kept fasted for further GA. Proponents of this technique have described feigning dropping a child, who may be understandably uncooperative, to cause reflex eye opening to enable a Krimsky test.[2] Examination in this setting is limited, as the authors themselves state, and may be insufficient in guiding adjustment. These children often remain under long-term follow-up. A negative experience at surgery may adversely affect their cooperation in future appointments.

Adjustment requires a second GA. Recent evidence has demonstrated the long-term neurocognitive safety of a single GA before the age of 36 months, but the effect of repeated GA on the developing brain remains unknown.[3]

We feel these factors are important and should considered prior to embarking on the technique described to maximise good surgical outcomes.

Conflict of interest

The authors declare no conflict of interest.