

ABSTRAK

Latar belakang: Astigmatisme kornea merupakan masalah yang kerap menyertai katarak. Implantasi lensa intraokular (IOL) torik terbukti dapat memberikan hasil yang baik dalam mengoreksi astigmatisme kornea. Hasil implantasi IOL torik sangat ditentukan oleh ketepatan penempatan aksis IOL. Metode *image-guided* merupakan baku emas dalam penentuan aksis IOL torik. Selain itu dapat digunakan metode pengukuran secara manual menggunakan slit lamp. Namun metode manual dianggap kurang akurat dibandingkan dengan metode *image-guided*. Penelitian ini bertujuan menentukan akurasi *alignment* aksis IOL torik dengan metode manual dibandingkan dengan metode *image-guided*, serta menentukan rumus penyetaraan antara metode manual terhadap metode *image-guided* untuk meningkatkan ketepatan dari penentuan aksis IOL torik secara manual.

Metode: Penelitian ini merupakan uji klinis 2 fase dengan desain *cross sectional* dan dilanjutkan dengan desain *randomized controlled trial*. Pada mata dengan katarak dan astigmatisme ≥ 1.00 D dilakukan operasi katarak dengan fakoemulsifikasi (Infiniti Vision System; Alcon, Fort Worth, USA) dan implantasi IOL torik (RayOne® Toric Lens; Rayner, UK). Evaluasi pra operasi mencakup pemeriksaan tajam penglihatan tanpa koreksi (UCVA) dan dengan koreksi (BCVA), keratometri, dan biometri optikal (IOL Master 700; Carl Zeiss Meditec AG, Jena, Germany). Penentuan aksis IOL torik dilakukan berdasarkan randomisasi sederhana, menggunakan metode manual dengan *slit lamp* pada 21 mata dan dengan metode *image-guided* (CALLISTO eye® system; Carl Zeiss Meditec AG, Jena, Germany) pada 21 mata sebagai kontrol. Pada *follow-up* pasca operasi hari ke 7 dan 30 dilakukan pemeriksaan UCVA, BCVA, serta pengukuran ketepatan aksis IOL torik menggunakan Mendez *degree gauge toric marker*. Analisis data mencakup perbedaan *alignment* aksis IOL torik antara kedua metode, analisis bivariat untuk menilai faktor yang bermakna terhadap target astigmatisme < 0.50 D, serta penentuan rumus penyetaraan antara metode manual terhadap metode *image-guided*.

Hasil: Terdapat perbedaan tajam penglihatan tanpa koreksi yang bermakna pada kelompok *image-guided* dengan kelompok manual pada hari ke-30 ($0,8 \pm 0,15$ versus $0,5 \pm 0,14$, $p < 0,01$). Rerata hasil residual astigmatisme < 0.50 D pada kelompok CALLISTO eye® adalah 81% dan 90,5% pada hari ke-7 dan 30 pasca operasi, sedangkan pada kelompok slit lamp adalah 76,2% dan 81%. Berdasarkan analisis bivariat, usia, jenis kelamin, lateralitas, jenis astigmatisme, jenis siklotorsi, mata dominan, panjang aksial bola mata, dan ketebalan lensa bukan merupakan faktor perancu terhadap target astigmatisme < 0.50 D (nilai p masing-masing variabel $> 0,05$). Didapatkan rerata perbedaan aksis antara metode manual dengan metode *image-guided* sebesar $10,98^\circ$ (95% *confidence interval* $9,32^\circ$ - $12,63^\circ$, $p < 0,01$). Rumus penyetaraan aksis *slit lamp* ditentukan berdasarkan lateralitas mata, berupa mata kanan = $-1,679 + 0,952$ (aksis *slit lamp*) - $2,877$ (jenis siklotorsi), dan mata kiri = $-2,939 + 0,975$ (aksis *slit lamp*) - $3,585$ (jenis siklotorsi).

Kesimpulan: Akurasi metode *image-guided* dan manual memiliki koefisien korelasi yang sangat baik. Kedua metode menghasilkan luaran tajam penglihatan tanpa koreksi yang berbeda bermakna dan terdapat perbedaan luaran *alignment* aksis IOL torik antara kedua metode. Selain faktor perlakuan, tidak terdapat faktor perancu yang memengaruhi luaran hasil target astigmatisme < 0.50 D dan didapatkan rumus penyetaraan aksis metode manual terhadap metode *image-guided*.

Kata Kunci: katarak, astigmatisme, metode *slit lamp*, metode *image guided* CALLISTO eye®

ABSTRACT

Background: Corneal astigmatism is a problem that often accompanies eyes undergoing cataract surgery. To correct corneal astigmatism, toric intraocular lens (IOL) implantation has been shown to provide good results. The outcome of toric IOL implantation is largely determined by the accuracy of the alignment. Image-guided methods, including the CALLISTO eye® system are the gold standard in determining the toric IOL axis alignment. Additionally, a more affordable manual method using a slit lamp can be used. However, the manual method is considered to be less accurate than the image-guided method. Therefore, this study aims to determine the accuracy of toric IOL axis alignment using the manual method as compared with the image-guided method and to determine the formula that can be used to adjust the result of the manual method to that of the image-guided method, to increase the accuracy of the manual method for toric IOL axis alignment.

Methods: This study is a two-phase clinical trial with a cross sectional design that was continued with a randomized controlled trial design. Eyes with cataracts and astigmatism 1.00 D underwent cataract surgery using phacoemulsification (Infiniti Vision System; Alcon, Fort Worth, TX, USA) and toric IOL implantation (RayOne® Toric Lens; Rayner, Worthing UK). The preoperative evaluation included uncorrected visual acuity (UCVA) and corrected visual acuity (BCVA), keratometry, and optical biometry (IOL Master 700; Carl Zeiss Meditec AG, Jena, Germany). The toric IOL axis was determined based on simple randomization, using the manual method with a slit lamp in 21 eyes and the image-guided method (CALLISTO eye® system; Carl Zeiss Meditec AG, Jena, Germany) in 21 control eyes. During follow-up on the 7th and 30th postoperative days, UCVA, BCVA, and the accuracy of the toric IOL axis were obtained using a Mendez degree gauge toric marker. Data analysis included differences in the alignment of the toric IOL axis between the two methods, bivariate analysis to assess the confounding factor for residual astigmatism of <0.50 D, and the determination of the adjustment formula between the manual method and the image-guided method.

Results: There was a significant difference in UCVA on day 30 between the image-guided group and the manual group (0.8 ± 0.15 versus 0.5 ± 0.14 , $p < 0.01$). The mean residual astigmatism < 0.50 D in the CALLISTO eye® group was 81% and 90.5% on the 7th and 30th postoperative days, respectively, while in the slit lamp group it was 76.2% and 81%, respectively. Based on bivariate analysis, age, sex, laterality, type of astigmatism, type of cyclotorsion, dominant eye, axial length of the eyeball, and lens thickness were not confounding factors for target astigmatism <0.50 D ($p > 0.05$). The mean axis difference between the manual method and the image-guided method was 10.98° (95% confidence interval $9.32^\circ - 12.63^\circ$, $p < 0.01$). The formula for the adjustment from the manual method differed depending on the laterality of the eye: for the right eye, it was $-1.679 + 0.952$ (slit lamp axis) $- 2.877$ (cyclotorsion type), and for the left eye, it was $-2.939 + 0.975$ (slit lamp axis) $- 3.585$ (cyclotorsion type).

Conclusion: Excellent correlation was seen between the accuracy of the image-guided and manual methods. Significantly different UCVA values were noted between the two methods, and differences were observed in the toric IOL axis alignment outcomes between the two methods. Apart from the methods used for IOL alignment, no confounding factors affected the outcome of residual astigmatism of <0.50 D and the formula for adjusting the axis of the manual method was obtained.

Keywords: cataracts, astigmatism, manual slit-lamp biomicroscopy, image-guided CALLISTO eye®