


# Surgical Grade and Repeat Laser Peripheral Iridotomy Procedures with Risk Stratification and Educational Considerations

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**Background/Aims:** Peripheral laser iridotomy (PLI) is a commonly performed procedure. While effective, repeat procedures (RPs) may be required for a variety of causes. We report the causes and rate of RP PLI and whether surgical grade is a risk factor.

**Methods:** Two years of retrospective data from 282 patients who had undergone PLI at a single UK ophthalmology department were retrieved using an electronic medical record system (Medisoft, Leeds, UK).

**Results:** A total of 253 patients underwent analysis with 20 requiring RPs. Our data identified a correlation between experience of the operating surgeon and an increase in RP rate, with statistical significance ( $p=0.036$ ) observed between consultants and registrars. No other statistically significant risk factors were identified from our study. Prescriber preference for iopidine was observed. From our findings and the current literature, prognostic factors that appear to influence RP rate include surgical grade, patient compliance, Asian ethnicity, and anticoagulation.

**Conclusion:** RP rate increases in PLI when a junior surgeon is performing the procedure, and thus cases with established prognostic factors for RPs should have senior input. Formal and standardized YAG-laser training should be implemented alongside risk stratification of patients to improve both trainee education and patient care.

**Keywords:** iris, glaucoma, education, laser treatment

## Introduction

Glaucoma is a group of conditions characterized by progressive damage to the optic nerve that occurs in an indicative pattern and results in associated changes in optic disk appearance and the visual field.<sup>1</sup> Its pathogenesis is complex and commonly but not exclusively associated with elevated intraocular pressure (IOP) that leads to retinal ganglion necrosis and consequentially damage to both the optic nerve head and the retinal nerve-fiber layer.<sup>1</sup> Peripheral laser iridotomy (PLI) is performed in patients with angle-closure glaucoma or narrow angles with or without the presence of glaucomatous optic disk damage. PLI is a regularly performed procedure, and is achieved by using a laser device to create an opening within the iris tissue to facilitate drainage of fluid from the posterior and anterior chambers.<sup>2,3</sup> This equalization in eye pressure minimizes pupillary block and reduces the risk of angle-closure glaucoma.<sup>2</sup>

In medical education, there exists a well-established equipoise between the requirement of a trainee to learn and perform a medical procedure with the potential

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increased risk of complications.<sup>4</sup> This phenomenon is observed throughout all medical specialities, such as endoscopy procedures, and also within ophthalmology itself, with an observed increase in posterior capsule-rupture rates during cataract surgery when performed by trainees.<sup>5,6</sup> As such, measures to reduce complications are essential for both patient safety and to reduce the impact on the educational development of trainees.<sup>7</sup> Such measures include simulated surgery, formal and standardized training, adequate supervision, and risk stratification of patients, such as the system developed to identify patients at high risk of posterior-capsule rupture in cataract surgery.<sup>5,8,9</sup> Notably, UK trainees have reported a lack of exposure and variable training/teaching in laser procedures.<sup>10</sup> PLI is a generally well-tolerated procedure, but complications can occur, including IOP rises and repeat procedures (RPs).<sup>11</sup>

Our study sought to assess if the grade of operating surgeon impacted the likelihood of a patient requiring a RP PLI. If an association was to be observed, it may warrant a change to educational training and the need for senior input in patients identified as higher risk.

## Methods

Retrospective data analysis was performed on 282 consecutive patients that had undergone PLI from 2018 to 2020 at the Ophthalmology Department of the Royal United Hospital, UK. The study was registered with the Royal United Hospital research team and received ethical and database approval (project ID 3431). Data were retrospectively gathered and anonymized with no identifiable information published, and thus patient consent was not required.<sup>12</sup> Data gathered comprised patient age, sex, glaucoma diagnosis, if the patient had attended follow-up, if an RP had been performed, the documented reason for this if applicable, baseline and postprocedure IOP, grade of the operating surgeon, and if the patient had been prescribed iopidine. Failed patency was defined as “absence of iris transillumination in the documented location where PI had been performed.” Resistant IOP was defined as “persistently elevated IOP that failed to be reduced by performing an initial PI and was presumed to be due to a PI that was not of adequate size.”<sup>13</sup> Preprocedural IOP was defined as the last documented IOP prior to procedure. Baseline IOP was defined as the documented IOP at 30–45 minutes postprocedure. IOP spike was defined as an increase in postprocedure IOP  $\geq 8$  mmHg.<sup>9</sup> A non-clinical case manager scheduled PLI appointments based on chronicity, and

thus patients and grades of operating surgeons were allocated randomly. Data analysis was performed to individually compare the RP rate between one grade of operating surgeon against another. This was performed on Microsoft Excel using the  $\chi^2$  test to assess statistical significance, defined as  $p < 0.05$ . Neither patients nor the public were involved in the design, conduct, reporting, or dissemination of our research.

In total there were 24 operating surgeons: four consultants, three associate specialists (ASpecs), 14 specialty registrars (SpRs), and two senior house officers (SHOs). As per UK medical training, defined grades of operating surgeons are 1–2 years of specialty training for SHOs and 3–7 years of specialty training for SpRs. ASpecs are middle-to senior-grade doctors who often work independently, but are attached to a clinical team led by a consultant, they are not on a formal training program nor do they hold a consultant post.<sup>14</sup> A consultant is a senior doctor who has completed their specialty training, works independently, and has a role in delivering care services and teaching and training of junior doctors, and takes ultimate responsibility for patient care. We used grades of operating surgeon as a surrogate for surgical experience, which other studies have demonstrated to be an accurate comparator.<sup>15</sup>

## Results

Of the 282 patients initially identified for the study, 253 were included and 29 excluded, due to a lack of follow-up data. Patients had a mean age of  $67 \pm 11.7$ , 31% were male, and 81% had undergone bi-lateral PLI. Table 1 shows the demographic data. Twenty patients required RPs, due to failed

**Table 1** Demographic Data of Patients

<b>n</b>	253
<b>Uni/bilateral procedure (%)</b>	48 (19%)/205 (81%)
<b>Age (years), mean <math>\pm</math> SD</b>	67 $\pm$ 11.7
<b>Age (years), range</b>	39–93
<b>Sex</b>	
Male, n (%)	79 (31%)
Female, n (%)	174 (69%)
<b>Ethnicity</b>	
Caucasian	249
Non-Caucasian	4
<b>Diagnosis</b>	
Primary angle closure suspected	236
Angle-closure glaucoma	7
Narrow-angle glaucoma	10

patency (12), intraoperative bleeding (5), resistant IOP (2), and not tolerating prior procedure (2). The number of PLIs performed per grade of operating surgeon was 113 for consultants, 43 for ASpecs, 81 for SpRs, and seven for SHOs. Mean IOP was baseline  $18.47 \pm 7.1$  mmHg and post-procedure  $17 \pm 4.9$  mmHg. In sum, 21 IOP rises postprocedure were observed. Eight patients were prescribed iopidine postprocedure from two prescribers.

Figure 1A demonstrates the rate of RPs by grade of surgeon, with an increase in RP rate observed with surgeons having less experience and seniority. When analysing RP rate per operating surgeon grade, statistical significance was found between consultants and SpRs ( $p=0.036$ , Figure 1B). No other statistically significant difference was found between grade of operating surgeon and RP rate. When comparing RP rates with

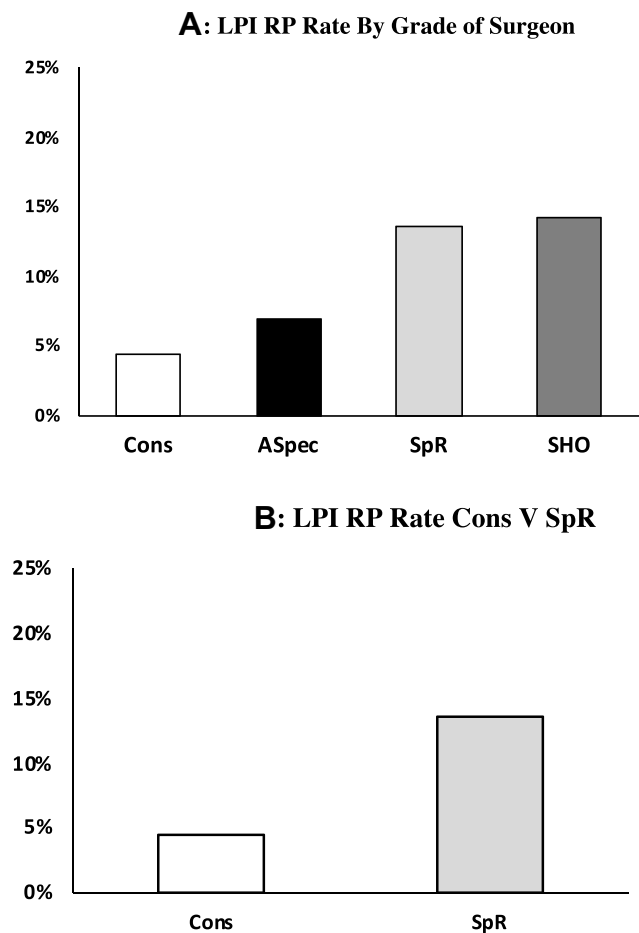
other demographic data, including age, sex, baseline IOP, and ethnicity, no statistical significance was observed.

## Discussion

Our data has identified a correlation between less experience of the operating surgeon and an increase in RP rate, with a statistically significant difference between SpRs and consultants observed. The difference in RP rate is also likely to be significant between consultants and SHOs, given their similar data distribution; however, it is likely that the low number of SHO PLI cases in our study failed to generate the statistical power necessary to demonstrate this. Our study's mean baseline and postprocedure IOP values and IOP spikes were comparable to other studies.<sup>9,16</sup> From the limited data on iopidine prescribing, a prescriber preference was observed.

Most research into prognostic factors for PLI and glaucoma has been within the acute setting, limiting its reliability in extrapolating it within our setting.<sup>17</sup> Previous literature has found that age, sex, and baseline IOP are not independent prognostic factors for likelihood of requiring RPs, which our study's findings also confirm.<sup>17</sup> However, the literature has identified Asian ethnicity as an independent prognostic factor for increasing the likelihood of requiring RPs.<sup>9,18</sup> When analyzing our data on ethnicity and RP rates, we observed no statistical significance, likely because of the small non-Caucasian population of the study (2%), which is representative of the local population, but differs from demographic data documented in other studies that have observed this difference.<sup>9</sup> The difference in RP rate for Asian ethnicity observed in other literature is believed to be due to greater laser-energy requirement to penetrate the iris to perform an iridotomy on the thicker dark-brown irides, more common in the Asian population.<sup>9</sup> Pretreatment argon-laser therapy has been suggested for this ethnic group when undergoing PLI in an attempt to thin and shrink the iris stoma.<sup>9</sup>

Assessment of the causes for patients requiring RPs within this study revealed that this was most commonly secondary to failed patency (60%), which may be explained by trainees performing smaller iridotomies, which are known to be at increased risk of closure.<sup>9,19</sup> Existing literature has found trainees use significantly more laser energy when performing PLI, which is likely to cause an increase in both complications and RPs.<sup>9</sup> Differences in laser energy when comparing iridotomy location and size have also been observed, which may contribute to the higher energy use observed in trainees,



**Figure 1 (A, B)** Comparison of RP rates by grade of surgeon: (A) decrease in RP rate with greater experience of operating surgeon; (B) statistically significant difference ( $p=0.036$ ) observed in RP rate between consultants and SpRs. Note the surgical grades. **Abbreviations:** ASpec, associate specialist; SpR, specialty registrar; SHO, senior house officer.

due to the lack of standardization when performing the procedure.<sup>9,20</sup>

The second–commonest cause for RPs within our study was intraoperative bleeding. While we did not investigate if patients had been taking anticoagulation periprocedurally, current literature demonstrates that patients that are anticoagulated are more likely to require RPs for PLI.<sup>21</sup> Furthermore, pretreatment with argon laser has also been shown to reduce intraoperative bleeding in PLI; however, its significance when the patient is anticoagulated is not known.<sup>22</sup> Another cause of RP PLI was patients not tolerating the procedure itself, which could potentially be anticipated prior to the procedure. This is an observed cause for RPs in other procedures, such as endoscopy and cataract surgery, with the patient instead receiving a general anaesthetic.<sup>23,24</sup> While this is not performed for PLI, senior involvement in this patient subcategory for other procedures has demonstrated an increase in patients tolerating procedures and reducing the need to proceed to general anesthesia.<sup>24</sup>

From this study's findings and with reference to current literature, prognostic factors that appear to influence RP rate include surgical experience, patient tolerance, Asian ethnicity, and anticoagulation.<sup>9,21,23</sup> Given that this study's findings demonstrate that trainees have a higher RP rate, it would seem logical to implement a risk-stratification system for PLI cases, similar to systems already in place for cataract surgery. Pretreatment with argon-laser therapy may be of benefit to some of these high-risk RP patients. Additional formal teaching and standardization of laser procedures is likely to help bridge the lack of exposure to these cases reported by trainees, and may help reduce RP PLI cases, added to which there is now additional global interest in reducing hospital appointments during the COVID-19 pandemic.<sup>25</sup>

## Limitations

The lack of PLI cases failed to generate enough statistical power to show a likely significant difference between other surgical grades and RP rate. Further limitations included poor documentation leading to limited conclusions concerning iodine use and the limited diversity noted in the demographic population of our study.

## Conclusion

RP-rate increases in PLI when a trainee is performing the procedure and thus cases where established risk factors have been identified should have senior input. Formal and standardized laser training should be implemented

alongside risk stratification of patients to improve both trainee education and patient care.

## Disclosure

The authors report no conflicts of interest in this work.

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