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激光周边虹膜切除术在原发性房角关闭治疗中的进展

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[摘要] 青光眼是全球第二大致盲眼病, 第一大不可逆性致盲眼病, 其中原发性闭角型青光眼(primary angle closure glaucoma, PACG)占25%。激光周边虹膜切除术(laser peripheral iridotomy, LPI)已成为PACG和原发性房角关闭的一线治疗。LPI机制为利用激光在周边虹膜上打孔, 解除PACG的瞳孔阻滞, 加深前房, 扩大房角, 恢复生理性房水排出途径, 从而降低眼压。研究表明LPI在原发性房角关闭各个疾病进程中均能比较好的控制眼压, 是相对安全的治疗方法。

[关键词] 原发性房角关闭; 激光周边虹膜切除术; 治疗进展

Progress of laser peripheral iridotomy in the treatment of primary angle closure

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Abstract Glaucoma is the second leading cause of blindness and the most common cause of irreversible blindness worldwide. Primary angle closure glaucoma (PACG) accounts for 25% of glaucoma. Laser peripheral iridotomy (LPI) has become the first line treatment for PACG and primary angle closure (PAC). The mechanism of LPI is to use laser to create a hole in peripheral iris to relieve pupil block, deepen anterior chamber, expand chamber angle, restore pathway of physiological aqueous discharge and reduce intraocular pressure. Studies have shown that LPI can control intraocular pressure well in all stages of PAC, which is safe for PAC.

Keywords primary angle closure; laser peripheral iridotomy; progress of treatment

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青光眼是全球第二大致盲眼病, 第一大不可逆性致盲眼病, 约影响8 000万人口^[1], 其中原发性闭角型青光眼(primary angle closure glaucoma, PACG)占25%^[2]。不同种族和民族的患病率差异很大, 超过3/4的患者生活在亚洲。在中国PACG导致至少1只眼致盲的人群超过300万, 其中150万人双眼失明^[3-4]。2019年中国PACG诊治专家共识^[5]指出: 虹膜-睫状体-脉络膜组成的葡萄膜病理生理改变在PACG发病机制中占重要作用, 是PACG发生和发展的始动因素, 并将PACG按发病机制分为5种类型: 单纯瞳孔阻滞型、虹膜高褶型、睫状体前位型、晶状体位置异常型、脉络膜膨隆型。我国PACG患者多存在多种发病因素^[5]。第3版眼科临床指南(Preferred Practice Patterns, PPP)从疾病进程考虑, 认为PACG是原发性房角关闭(primary angle closure, PAC)的一类, 将PAC分为四类: 1)可疑原发性房角关闭(primary angle closure suspect, PACS), 指 $\geq 180^\circ$ 的虹膜小梁网接触(iridotrabecular contact, ITC), 眼压正常且无视神经损伤, 无周边虹膜前粘连(peripheral anterior synechiae, PAS); 2)原发性房角关闭(primary angle closure, PAC), $\geq 180^\circ$ 的ITC和PAS, 或眼压升高, 无视神经损伤; 3)PACG, $\geq 180^\circ$ 的ITC和PAS, 和眼压升高, 和视神经病变; 4)急性前房角关闭危象(acute angle-closure crisis, AACCC)或急性原发性房角关闭(acute primary-angle closure, APAC), 房角关闭伴有症状性眼压升高^[6-7]。

1956年, Meryer-Schwickerath^[8]首次使用氩弧光光凝器在虹膜上打孔。自上个世纪70年代以来, 氩激光技术出现, 激光周边虹膜切除术(laser peripheral iridotomy, LPI)被应用于临床。到70年代末, LPI已成为PAC的一线治疗^[9]。本文就LPI在PAC的应用进展做介绍。

1 LPI工作原理及降压机制

LPI的基本原理是利用激光在周边虹膜上打孔, 使前房和后房之间压力平衡, 解除PACG的瞳孔阻滞, 加深前房, 扩大房角, 促使虹膜远离小梁网, 恢复生理性房水排出途径, 从而降低眼压。激光打孔的位置应优先选择四个象限内虹膜隐窝或基质层较薄的部位, 避开虹膜血管。临床上常规选择被上睑遮盖的上方虹膜区, 以避免术

后眩光的发生。而为避免术中气泡的遮挡, 一般不选择12点位进行LPI。Srinivasan等^[10]研究报道: 打孔位置与射击次数和总能量有关, 上方虹膜11~1点较鼻侧2~4点、颞侧8~10点, 需要更多射击次数和总能量, 但Vera等^[11]报道激光射击次数和总能量与打孔位置无关。

1.1 氩激光

氩激光的打孔原理主要是利用热效应, 氩激光产生的热量被虹膜组织吸收, 短暴露时间和高能量/面积比可降低热的传导, 使组织达到临界沸点, 产生气泡使组织破裂, 并通过微爆破使组织产生光汽化现象, 这种反应可在虹膜上打孔。连续波长氩激光手术有3种方法: 1)“隆起(hump)”技术; 2)“鼓面”技术, 即先用直径较大, 能量较低的光斑作用于虹膜, 使虹膜局部隆起或充分伸展, 再用小光斑、高能量的激光束穿透隆起或伸展部位; 3)直接用激光束多次烧灼虹膜, 直至穿透虹膜^[12]。用激光束直接穿通虹膜根据患者虹膜色深、浓密、厚的特点, 金家焱等^[13]采用高功率、击射次数多的“原位分层透切法”, 取得了满意的疗效。

1.2 钕: 铈铝石榴石(Nd:YAG)激光

Nd:YAG激光是目前LPI广泛使用的激光能源, 激光能量高, 照射时间短, 通过电化学反应使虹膜组织爆破。YAG激光常采用5~15 mJ范围的能量水平, 同时击穿虹膜基质和色素上皮。目前已成为临床上最为常用的LPI的能源^[12]。

1.3 其他激光及联合应用

LPI的其他激光技术还包括脉冲氩激光、钕: 钪铈氟化物(Nd:YLF)激光、半导体二极管激光、氦激光、Q-开关红宝石激光、单脉冲染料激光、倍频Nd:YAG激光等^[12]。彭大伟等^[14]曾在200只眼行氩激光和Nd:YAG联合周边虹膜切除术, 先用氩激光做深达2/3~3/4基质厚度的分层击射, 后用Nd:YAG激光做穿透击射, 效果理想。王光洁等^[15]研究发现: 氩激光和Nd:YAG联合激光逐层透切法性虹膜周边切除术可显著减少2种激光的能量, 提高手术成功率, 降低并发症发生率。李政康等^[16]与冯春阳等^[17]先后报道: 倍频Nd:YAG激光联合YAG激光治疗闭角型青光眼安全、有效。

2 LPI 的临床疗效

2.1 PACS

对于PACS, 是否广泛预防性应用LPI尚存争议。卞爱玲等^[18]报道: PACS组患者接受LPI治疗后5年以上的眼压控制满意率为88.9%(16/18)。PACS患者进行LPI短期及长期均能加深中央前房深度, 且长期观察激光组前房深度变浅小于对照组^[19-20], 但这种效果在12个月后显著减少^[21]。Peng等^[22]随访了LPI术后239例PACS患者, 评价随访时间为56个月, 眼压高于21 mmHg(1 mmHg=0.133 kPa)的为18%, 7%的患者需要进一步降眼压药物治疗, 0.4%的患者接受了抗青光眼手术。2010年一项针对蒙古人群的大样本、随机对照研究^[23]提示: 年龄50岁以上人群, 无论是否进行预防性LPI, 1.6%的PACS在6年内最终发展为PACG, 预防性LPI组与对照组无统计学意义。中山眼科中心何明光及其团队^[2]进行了一项6年单中心、随机对照试验, 预防性LPI组对比未治疗组, 发展为PAC的或者急性闭角型青光眼的风险降低了47%, 两组差异有统计学意义, 但研究中观察到PACS进展为PAC的发生率小于1%, 远低于既往报道的22%, 19.4%^[24-25], 进行预防性LPI仅有少部分患者受益, 故不推荐预防性LPI广泛应用于PACS。

2.2 PAC

目前, LPI被认为是预防PAC患者房角关闭及治疗PACG反复发作的首选方法^[18]。PAC和PACG行LPI术后周边房角均明显增宽^[26-29], 但是长期眼压控制效果不佳。Dada等^[26]使用UBM测量54只PAC眼LPI术前及术后2周的房角开放距离500(Angle opening distance, AOD500)由0.107 mm增加为0.208 mm, 较术前增加了94%。牟大鹏等^[27]报道: PAC患者术后巩膜突前750 μm 处房角开放距离(angle opening distance, AOD)由(0.19 \pm 0.10) mm增至(0.40 \pm 0.41) mm ($P<0.05$); 前房深度(anterior chamber depth, ACD)由(1.64 \pm 0.44) mm增至(2.70 \pm 2.32) mm ($P<0.05$); 房角隐窝面积(angle recess area, ARA)由(0.12 \pm 0.05) mm增至(0.23 \pm 0.09) mm ($P<0.05$)。一项前瞻性的研究^[30]显示: 在50例PAC眼LPI术前和术后1个月进行不同的激发试验, 使用散瞳剂后, LPI术后眼压升高的比例由26%降至15%。卞爱玲等^[18]报道:

PAC患者接受LPI治疗后随访5年以上, 眼压低于21 mmHg为38.8%(38/98), 大于21 mmHg需联合药物或激光周边虹膜成形术为48%(47/98), 发生房角急性关闭或需联合滤过手术为13.3%(13/98)。在3个回顾性研究中, PAC患者LPI术后需要进一步治疗的比例为42%^[21], 56%^[31], 67%^[32], 随访时间分别为12年、50个月、46个月, 接受青光眼手术的比例为0%~13%, PAC进展为PACG的比例为5%~9%^[21,32]。

2.3 PACG

印度一项39只PACG患眼行LPI后, ACD, AOD₅₀₀、小梁虹膜夹角(trabecular-iris angle, TIA)术前及术后2周无明显统计学差异^[26]。Kaushik等^[28]报道PACG患者LPI术前和术后3周通过房角镜观察, 激光作用象限房角宽度增加了200%, 其他象限平均增加了17%; UBM测量AOD500由110.2 μm 增加为170.6 μm 。3项回顾性研究^[21,30-31]显示: 83%~100%的PACG患眼LPI术后需要进一步联合药物治疗, 20%~43%需要进一步联合抗青光眼手术治疗。若伴有急性发作病史, 进一步手术率为41%(11/27), 明显高于没有急性发作病史手术率的20%(21/103)。高C/D比值和房角粘连程度是PACG患者LPI术后需要行抗青光眼手术的危险因素^[30]。

2.4 APAC

APAC的初始治疗目标为降低眼压, 解除急性症状, 控制潜在的高眼压。由于LPI有相当好的危险-效益比, 因此是最恰当的手术治疗方法^[6]。Moghimi等^[29]报道: 52只APAC接受LPI术后6周, 房角镜观察房角由0.25级(Shaffer等级)增宽至1.22级, 增宽了388%, 通过前节OCT(anterior segment OCT, AS-OCT)测量, 鼻侧的AOD500和TISA750增加了120%和93%。Ahmadi等^[33]观察150只APAC眼, LPI术前PAS为180°; LPI术后2个月, 上方激光孔和下方激光孔房角分别增宽了0.11级、0.16级。Lim等^[34]对44只APAC眼行LPI, 随访1年, 发现术后2周房角增宽约0.37级, 随访期间PAS稳定, 但43%的患眼IOP超过正常值, 需要接受药物或手术治疗。

约50%的APAC对侧眼会在5年内呈急性发作^[35], 因此需对APAC对侧眼进行评估, 若为解剖的窄前

房角, 需进行预防性LPI^[6]。Ahmadi等^[33]研究发现LPI术后2个月, 上方激光孔组和下方激光孔组分别增宽0.11级、0.16级。Lim等^[34]观察APAC对侧眼PLI术后2周房角增宽约0.33级, 术后4个月增加约0.98级, 且随访期间虹膜前粘连未发生改变。梁涛等^[36]报道对18例APAC对侧眼LPI术后暗室下进行UBM检查, 发现至少1个方位发生接触性房角关闭的有26眼(33%), 其中3 min暗室激发试验阳性的有19眼(24%)。Vera等^[37]对70例APAC对侧眼行LPI, 平均随访6.3年, 7%进展为PACG。Ang等^[35]对80例APAC对侧眼随访50.8个月, 发现2例进展为PACG, 8例房角镜下观察到间歇性房角关闭, 这10例眼压均高于21 mmHg。

3 LPI 和手术虹膜周边切除对比

手术虹膜周边切除(surgical peripheral iridectomy, SPI)的原理和LPI相同, 但因SPI需要切开眼球壁, 具有增加患者痛苦、并发症多、增加患者经济负担等缺点, 已基本被LPI取代^[38]。Go等^[39]对149例PACG患者195只眼进行了平均44.5个月的随访, 发现SPI的眼压控制满意率为75.3%, LPI的眼压控制满意率为76.4%。Fleck等^[40]对52只APAC对侧眼平均随访11.8月, 发现LPI组和SPI组平均眼压分别为14.3 mmHg和14.9 mmHg, 眼压和视力差异无统计学意义。Fleck等^[41]对21例APAC患者行双眼SPI, 27例行双眼LPI, 随访3年, LPI组视力0.57, SPI组视力0.30($P=0.08$); LPI组和SPI组眼压低于21 mmHg分别为70.4%和71.8%($P>0.05$)。一项对161例PACG的回顾性研究报道^[42]显示: SPI和LPI组的最佳矫正视力差异无统计学意义($P=0.63$); 但LPI组需要二次手术的风险明显高于SPI组。高新博等^[43]探讨LPI与SPI术后对血-房水屏障的影响, 发现二者均影响血-房水屏障, 术后1周内LPI重, 2周后基本恢复。

4 LPI 的并发症

LPI常见的早期并发症有暂时性眼压升高、虹膜睫状体炎, 其他并发症包括前房出血、晶体损伤、角膜内皮损伤、激光孔闭塞、恶性青光眼、视力模糊、视网膜烧伤等^[44-45]。Waisbourd等^[44]对66例青光眼患者双眼行LPI, 结果显示: 术后

0.5~2 h, 12.1%(8/66)眼压较术前升高大于5 mmHg, 6.1%(4/66)升高大于10 mmHg, 其中9.1%需用降眼压药物治疗; 19.7%在6个月内因激光孔闭塞再次行LPI; 3%(2/66)发生前房出血, 1.5%发生眩光; 暂时性眼压升高的程度在不同种族间有差异, 差异无统计学意义。侯旭等^[45]回顾了362例512只眼进行LPI后的早期并发症, 发现虹膜出血107眼(20.9%)、暂时性眼压升高85眼(16.6%)、虹膜睫状体炎14眼(2.7%)、角膜损伤10眼(2%)、晶状体损伤2眼(0.4%)、减压性视网膜病变1眼(0.2%)、渗出性视网膜脱离2眼(0.4%); 虹膜出血在急性闭角型青光眼患者中发生率最高(33.7%, $P=0.019$), 暂时性眼压升高在慢性闭角型青光眼患者中发生率最高(23.0%, $P=0.047$)。长期随访中, Vijaya等^[46]将190例接受LPI治疗的PACS患者和3 015例未接受LPI的对照组进行了6年的对比, 发现治疗组白内障发生率明显高于对照组, 差异有统计学意义。

LPI术后的视觉质量障碍主要包括视物模糊、重影、眩光、阴影及光晕等^[10,47], 视觉障碍与虹膜周切孔位置、周切孔的大小、造孔总能量是否相关尚有争议。Congdon等^[47]研究了217例上方周切孔的LPI的患者与250例正常患者进行对比, 发现LPI术后视觉障碍的发生与眼睑是否遮盖周切孔、周切孔的大小及激光总能量无相关性。Srinivasan等^[10]对比了285例上方周切孔的LPI和鼻侧/颞侧周切孔的LPI, 术后鼻侧/颞侧周边孔的视觉障碍发生率较上方周切孔组高, 但差异无统计学意义, 结论与Congdon等^[47]类似。而Vera等^[11]则报道颞侧周边孔出现视觉障碍较少。

5 结语

我国2019年版PACG诊治专家共识建议对于有房角关闭、眼压升高、有瞳孔阻滞因素的患者, 首选LPI或者SPI^[5], 若存在非瞳孔阻滞因素, 则选择氩激光周边虹膜成形术(argon laser peripheral iridoplasty, ALPI)^[38]。美国PPD^[6]建议各个阶段的PAC首选LPI。考虑到闭角型青光眼为多因素发病机制, 在临床中应该仔细鉴别LPI的适应证, 为闭角型青光眼患者选择合适的治疗方法。

综上, LPI在PACG各个阶段均能加深房角宽度, 能够比较好的控制眼压, 是相对安全的治疗方法。但由于LPI治疗后, 相当比例的患者需要进

一步治疗, 提示在临床工作中, 对于PACG患者, 解除瞳孔阻滞因素后, 还需仔细鉴别是否合并其他发病机制, 对PACG患者应进行定期随访。

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