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温敏性几丁糖填充兔眼玻璃体两种手术方式对比研究 *

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摘要 目的:通过两种手术方式对兔眼玻璃体进行温敏性几丁糖填充,比较其眼压及并发症差异。**方法**:将 18 只白兔随机分为实验组和对照组,每组各 9 只,右眼均为手术眼,实验组白兔行玻璃体切割术并注入温敏性几丁糖,对照组通过 1 mL 注射器抽取玻璃体并填充温敏性几丁糖,术后随访 1 月,对比两组白兔术后眼压及手术并发症的差异性。**结果**:实验组手术前眼压(7.76± 2.21) mmHg 与术后眼压(7.49± 2.98) mmHg 无明显差异(P＞0.05),对照组手术前眼压(7.80± 2.04) mmHg 与手术后眼压(5.17± 0.96) mmHg 有统计学意义(P＜0.05)。对照组术后并发症发生率为 44.4%(4/9),明显高于实验组 22.2%(2/9)。**结论**:玻璃体腔注射温敏性几丁糖操作简单,但并发症较多,且易造成眼压改变;而玻璃体切割术后填充温敏性几丁糖并发症相对较少,眼压波动较小,但应注意并发性白内障的发生。

关键词:玻璃体切割术;玻璃体注射;温敏性几丁糖;眼压;并发症

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The Comparison of Two Operations for Filling the Vitreous Body of Rabbits with Thermosensitive Chitosan-based Hydrogel*

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ABSTRACT Objective: The experiment was designed to measure the effects of two different eye operations for experimental animals. Comparing the differences of the intraocular pressure and the complications of two groups of rabbits, whose vitreous body were filled with thermosensitive chitosan-based hydrogel through two different ways of operations. **Methods:** We divided 18 rabbits into two groups, 9 for control group and 9 for experimental group. The right eyes were selected for operation for both groups. In the control group, we used 1ml injector to extract the vitreous body and then filled it with thermosensitive chitosan-based hydrogel. While we conducted vitrectomy and then filled the vitreous body with thermosensitive chitosan-based hydrogel for the experimental group. After the operations, we followed up for a month to compare the intraocular pressure and the complications of the two groups of rabbits. **Results:** In the experimental group, there is no statistically significant difference between the eye pressure before operation and that after operation (P>0.05). While the eye pressure is significantly different in the control group, before and after operation (P<0.05). The incidence of complications in the control group after the operation is 44.4% (4/9), which is much higher than incidence in experimental group 22.2%(2/9). **Conclusions:** The operation of injecting thermosensitive chitosan-based hydrogel into vitreous body is easier to conduct, but is also more likely to cause intraocular pressure change. While, the operation of filling thermosensitive chitosan-based hydrogel after vitrectomy will not cause intraocular pressure change, and leads to less complications, but the attention of complicated cataract should be taken.

Key words: Vitrectomy; Intravitreous injection; Thermosensitive chitosan-based hydrogel; Intraocular pressure; Complications

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前言

玻璃体为透明凝胶状,其具有屈光性和不可再生性,并具有支撑视网膜、减缓外力冲击等[1]。目前玻璃体切除术已成为治疗玻璃体视网膜疾病的常用手术方法之一[2]。而实验性玻璃体置换术一般分为两种:一种是玻璃体腔注射[3],另一种为玻璃体切割术[4]。近几年,人工玻璃体是眼科最富有挑战性的研究领域之一[5],其中温敏性几丁糖具有良好的生物相容性,无色透明,屈光指数与玻璃体相近,有待成为新的理想人工玻璃体[6]。不少实验探讨了人工玻璃体填充后对眼睛微环境的影响,但忽略了不同的手术操作方式也可能为实验带来误差。温敏性几丁糖因其温度调节性,可在 37℃左右迅速由液态转变为凝胶状,减少手术过程中注入凝胶的能量损失[6]。本实验通过对温敏性几丁糖填充兔眼玻璃体两种手术方式术后眼压及并发症的对比,分

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析其差异，现将结果报道如下。

1 对象及方法

1.1 对象

新西兰白兔 18 只，雌雄兼备，体重约 2.5～2.8 kg，每日给予常规级颗粒饲料喂养，可自由饮水。手术前常规裂隙灯显微镜及间接检眼镜检查，非接触式眼压计测量眼压，排除有眼疾的兔子。

1.2 方法

18 只白兔随机分两组，实验组 9 只，对照组 9 只，每组均选取右眼为术眼，左眼不作任何处理。

两组术前均用复方托吡卡胺滴眼液眼药水进行散瞳，然后通过耳缘静脉注射戊巴比妥钠麻醉(35 mg/kg)。对照组用 1 mL 注射针于颞侧角膜缘后 4 mm 处刺入玻璃体腔，抽取玻璃体 0.3～0.5 mL，针头斜面避免刺向视网膜，随即用同一针头注入等量温敏性几丁糖，确认置换满意后拔出针头，立即用湿棉签压迫针眼 1 min[7]。

实验组白兔行常规三通波切术，右眼分别于角膜缘后做巩膜三切口，置入灌注头、玻璃体切除头和导光纤维头[8]。玻璃体不完全切除约 0.3～0.5 mL，平衡盐溶液作进行气液交换，填充相应温敏性几丁糖。

术后随访 1 月，对比两组白兔术后眼压及手术并发症的差异。

1.3 统计学分析

使用 SPSS 21.0 统计软件分析，计量资料以率表示，进行配对 t 检验。P<0.05 差异具有统计学意义。

2 结果

2.1 对照组与实验组手术前后眼压比较

实验组手术前后眼压无明显差异(P＞0.05)，而对照组手术前后眼压差异有统计学意义(P＜0.05)。见表 1。

表 1 两组手术前后眼压比较

Table 1 Comparison of the difference of IOP between preoperative and postoperative

Groups	Preoperative	Postoperative	P
Test Group	7.76± 2.21	7.49± 2.98	0.84
Control Group	7.80± 2.04	5.17± 0.96	0.003

Note: compared with the preoperative, #t=0.209, P>0.05; compared with the preoperative, *t=3.892, P<0.05.

2.2 术后并发症的比较

两组术后均伴有不同程度结膜充血和轻度葡萄膜反应，约 1 周后消退。实验组 9 只兔眼中 1 只兔眼由于术中损伤晶状体发生医源性白内障，1 只兔眼 2 周后发生晶状体浑浊(图 C)，并发症发生率为 22.2%(2/9)。9 只对照组兔眼中 2 只兔眼前房变浅，可见填充物渗入(图 A，图 B)；1 只兔眼发生视网膜脱离，1 只兔眼发生白内障，并发症发生率为 44.4%(4/9)。两组玻璃体内均可见分界清楚的透明凝胶团。

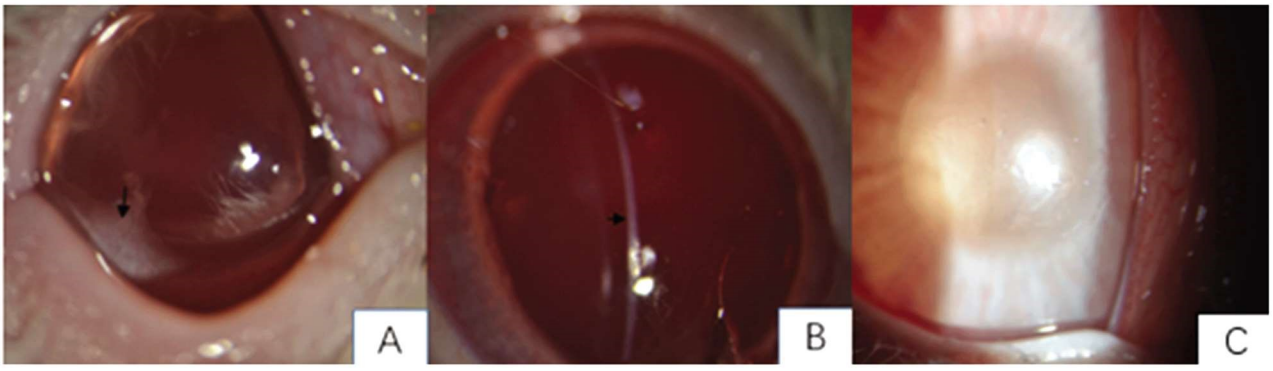

图 1 两组白兔并发症比较

Fig.1 Comparison of the complication of rabbits between two group

Note: Fig.A: exudant seep into atria, FigB: shallow anterior chamber, FigC: opacity in the lens.

3 讨论

实验性玻璃体置换术一般分为两种：一种是玻璃体腔注射法，另一种为玻璃体切割术法。玻璃体腔注射法不仅简单易操作，同时可以注射缓释药物治疗相关视网膜眼底疾病[9]。常规三通玻璃体切割术手术过程操作较难，但其可有效进行玻璃体大范围切除。通过两组不同手术方式行不完全玻璃体切除，比较其眼压及并发症，有助于了解手术方式不同而造成的差异性。

通过两组术后眼压比较，可见玻璃体切割填充手术前后白兔眼压变化不明显，而玻璃体腔内注射法术后与术前眼压有差异，整体降低，这可能与针刺巩膜切口未愈合，房水从穿刺口少量渗漏有关。玻璃体腔注射填充法由于注射位置不明确，过浅填充物则易渗入前房，导致房角变窄，眼压升高；注射过深则可能由于抽吸压力引起视网膜脱离。在不少试验中，玻璃体腔注射均可导致高眼压发生，如玻璃体腔内注射曲安奈德注射液术后眼压增高的发生率一般在 9%-52%[10,11]。实验组通过巩膜三个切口，进入灌注头、玻璃体切除头和导光纤维头，可视玻璃体内位置，切除速度缓慢均匀，但术后仍需警惕并发性白内障发生。本实验并发性白内障产生的原因可能有以下两个方面：一是由于手术时间过长，动物麻醉时间未掌控好，手术操作中容

易导致晶状体损伤,发生医源性白内障[12];二是与填充物质有关,一旦填充物接触晶状体后囊,影响晶状体物质代谢,造成转运障碍,进一步引起氧化损伤等[13]。

临床常用的主要有空气、惰性气体、重水、硅油、重硅油等[14]。凝胶制剂与玻璃体有相似的生物形态,被认为是理想人工玻璃体选择之一[15]。通常手术者将填充物直接注入玻璃体,接触视网膜,其表面张力可支撑视网膜。然而,异物填充易导致一系列的术后并发症,如并发性白内障、继发性青光眼、葡萄膜炎等[16]。两组实验均发生短暂性结膜充血,但未见明显葡萄膜炎,这可能与温敏性几丁糖良好的生物相容性有关。众多人工玻璃体中,水凝胶是一种在眼科极其具有潜力的应用材料[17,18]。而几丁糖属于碱性多糖,无毒副作用,并可抑菌,具有良好的生物相容性,并可进行生物降解,近年来几丁糖作为细胞外基质支架材料逐渐成为人们研究的热点[19]。而温敏性几丁糖具有高度智能的温度响应性,同时该响应具有可逆性,可由液态(2℃-4℃)迅速转化为凝胶(37℃)[20],从而便于注射及药物缓释。本实验首次将其作为玻璃体填充物,有关温敏性几丁糖填充玻璃体安全性研究有待进一步深入。

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