Efficacy and safety of green laser photocoagulation for threshold retinopathy of prematurity

Eficácia e segurança da fotocoagulação com laser verde na retinopatia da prematuridade limiar

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ABSTRACT

Purpose: To report the efficacy and safety of green laser photocoagulation for threshold retinopathy of prematurity (ROP). **Methods:** We reviewed the clinical records of the neonates who had undergone green laser photocoagulation for threshold ROP at the Federal University of Pernambuco in Brazil between January 2004 and January 2006. All procedures were conducted with local anesthetic drops. The neonates were monitored throughout the procedure by a neonatologist. A frequency-doubled solid state laser, diode-pumped, with 532 nm wavelength was used. The presence of *tunica vasculosa lentis* or cataract were excluded before laser treatment. The following preoperative data were obtained for each patient: age, birth weight and the grade of ROP. Postoperative data included complications associated with the laser treatment, grade of ROP and evaluation whether further surgery was necessary due to failure of laser photocoagulation. **Results:** Twenty-two neonates underwent photocoagulation with green laser for threshold ROP. A total of 31 eyes were included in the study. The mean gestational age was 30 ± 3 weeks and the mean birth weight was 1120 ± 490 g. Regression of the disease after laser therapy was observed in 30 eyes (96.7%). Despite treatment one eye presented stage 4A. Only 7 eyes required repetitive laser therapy. No adverse effects such as burning anterior segment tissues or bleeding in the anterior chamber occurred. No posterior segment side-effects were observed. Cataract formation was not observed at the last follow-up examination. **Conclusions:** Green laser photocoagulation remains an effective and safe alternative to red laser photocoagulation and to cryotherapy in the treatment of threshold ROP.

Keywords: Retinopathy of prematurity; Laser coagulation; Treatment outcome

Trabalho realizado na Universidade Estadual de Campinas - UNICAMP - Campinas (SP) - Brasil e na Universidade Federal de Pernambuco - UFPE - Recife (PE) - Brasil.

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Recebido para publicação em 08.02.2007
Última versão recebida em 15.09.2007
Aprovação em 25.09.2007

INTRODUCTION

According to the World Health Organization, 500,000 children go blind every year, and half of these cases are preventable. In middle income countries, retinopathy of prematurity (ROP) is among the leading causes of blindness, the incidence of which can be reduced through availability and affordability of screening and curative services[1-2].

Retinopathy of prematurity is a disease that affects the immature vasculature in the eyes of premature babies. It can be mild with no visual defects, or it may become aggressive with new blood vessel formation (neovascularization) and progress to retinal detachment and blindness. As smaller and younger babies are surviving, the incidence of ROP has increased[3-4].

In the Cryotherapy Study for ROP[5], and Early Treatment ROP Study[6] excellent results were achieved if ROP was treated with either indirect laser photocoagulation or cryotherapy.

Laser therapy can be delivered using red (diode) or green (argon or frequency-doubled solid state laser diode-pumped) wavelength. The risk of acquired cataract after transpupillary laser photocoagulation for ROP is low[7]. However, some authors report that red laser photocoagulation may be safer than argon laser photocoagulation[8-9].

The aim of this study was to report the efficacy and safety of green laser photocoagulation for threshold ROP.

METHODS

We reviewed the clinical records of the neonates who had undergone green laser photocoagulation for threshold ROP at the Federal University of Pernambuco in Brazil between January 2004 and January 2006. Threshold ROP was determined as five or more contiguous or eight cumulative 30-degree sectors of stage 3 ROP in the presence of 'plus' disease[5]. The study protocol was approved by the Ethics Committee (CONEP 0146.0.172.000-06).

All procedures were conducted with local anesthetic drops (Anestalcon®, Alcon). The neonates were monitored throughout the procedure by a neonatologist. Tight scatter of laser application was performed, with a burn diameter between burns, from the area posterior to the ridge up to the *ora serrata*. The avascular retina was treated with moderate white burns. A frequency-doubled solid state laser, diode-pumped, with 532-nm wavelength (Visulas 532® Carl Zeiss) was used. The presence of *tunica vasculosa lentis* or cataract were excluded before laser treatment.

The following preoperative data were obtained for each patient: age, birth weight and the grade of ROP. Postoperative data included complications associated with the laser treatment, grade of ROP and evaluation whether further surgery was necessary due to failure of laser photocoagulation. Follow-ups to assess the anatomic result were performed weekly until ROP regression occurred. Unfavourable outcomes were assessed in accordance with the Cryotherapy Study for ROP[5].

RESULTS

During the period from January 2004 to January 2006, twenty-two neonates underwent photocoagulation with green laser for threshold ROP. A total of 31 eyes were included in the study. The mean gestational age was 30 ± 3 weeks (range 24-32 weeks) and the mean birth weight was 1120 ± 490 g (range 595-1955 g). The average laser power used was 150 mW, with duration of 0.1 s and the mean number of burns was 320 per eye. The mean follow-up time was 8 ± 3 months.

Signs of ROP regression after laser therapy were observed at the first week in 24 eyes (77.4%). Only 7 eyes (22.6%) required repetitive laser therapy, with evidence of disease regression one week later. Six weeks after treatment there was total ROP regression in 30 eyes (96.7%). Despite treatment one eye presented stage 4A.

No adverse effects such as burns in anterior segment tissues or bleeding in the anterior chamber occurred. No posterior segment side-effects were observed. Cataract formation was not observed at the last follow-up examination.

DISCUSSION

Currently, laser treatment is the best therapy available for threshold ROP. It causes less effusion than cryotherapy and has at least as good results from an anatomical and visual standpoint[10-12]. In the not so distant future, it may be that pharmacologic therapy will be possible[7,13-16]. Besides the immediate short-term results it seems that laser therapy may also be beneficial in respect to longterm functional and visual outcome. Eyes treated with cryotherapy have been found to be significantly more myopic than those treated with laser photocoagulation[10-12,17]. Although laser has definite advantages, cryotherapy can be considered as an alternative modality of treatment in developing countries due to economic reasons[10-12].

Laser complications of the anterior segment can include burns to the cornea, iris and *tunica vasculosa lentis* with induction of cataract, anterior ischemia, bleeding into the anterior and posterior chambers[12,18-19]. In our study none of these complications occurred after laser application. Minor spot bleeding at the ridge may occur but these hemorrhages are reabsorbed spontaneously. Laser treatment showed favorable results in our study, inducing regression of threshold ROP in 96.7% of all treated eyes.

It should be noted that cataracts, as well as anterior segment ischemia, can be observed after laser treatment with either green or red wavelength[7]. The incidence of cataract formation with laser photocoagulation is low and may be more likely to occur when persistent hyaloidal vessels are present on the lens[8,20-21].

The red laser machine is cheaper but the green laser is less painful[8-9,22]. There are many public hospitals in Brazil that had bought green laser, but do not have a red diode laser or an adequate cryotherapy machine. In these institutions green laser can become a good option to treat most cases of ROP.

The lack of controls and the lack of randomization limit the results of our study. Nevertheless our findings are encouraging with respect to the efficacy and safety of green laser photocoagulation as a valuable alternative to red laser and to cryotherapy.

CONCLUSION

Green laser photocoagulation remains an effective and

safe alternative to red laser photocoagulation and to cryotherapy in the treatment of threshold ROP. Randomized clinical trials are necessary to further validate these results.

ACKNOWLEDGEMENTS

Adeildo Simões da Silva, MD: collaborated intellectually in giving scientific advice and critical review of the research.

RESUMO

Objetivos: Avaliar a eficácia e segurança da fotocoagulação com laser verde na retinopatia da prematuridade (ROP) limiar. **Métodos:** Foram revisados prontuários dos neonatos submetidos à fotocoagulação com laser verde para ROP limiar, na Universidade Federal de Pernambuco, entre janeiro 2004 e janeiro 2006. Tratamento foi realizado com anestesia tópica, sob monitorização de neonatologistas. Foi utilizado laser verde de estado sólido com diodo de freqüência dobrada de 532 nm. Presença de túnica vasculosa lentis ou catarata foi excluída antes do tratamento. Foram obtidos os seguintes dados pré-operatórios: idade, peso ao nascer e estágio da ROP. Dados pós-operatórios incluíram complicações associadas com o tratamento, estágio da ROP e avaliação da necessidade de cirurgia por falha do tratamento com fotocoagulação. **Resultados:** Vinte e dois neonatos foram submetidos à fotocoagulação com laser verde para ROP limiar. Um total de 31 olhos foi incluído no estudo. A idade gestacional média foi de 30 ± 3 semanas e a média do peso ao nascer foi de 1120 ± 490 g. Regressão da doença após terapia com laser foi observada em 30 olhos (96,7%). Apesar do tratamento um olho evoluiu para estágio 4A. Apenas 7 olhos precisaram de mais uma sessão de laser. Não houve efeitos adversos na câmara anterior como queimaduras ou sangramentos. Também não foram observados efeitos colaterais no segmento posterior. Formação de catarata não foi observada até o final do acompanhamento. **Conclusões:** A fotocoagulação com laser verde é uma alternativa efetiva e segura à fotocoagulação com laser vermelho e à crioterapia para o tratamento da ROP limiar.

Descritores: Retinopatia da prematuridade; Coagulação por laser; Resultado de tratamento

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