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Results of screening and treatment of retinopathy of prematurity over a 10-year period in one neonatal unit of Bulgaria

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Background: This study reports the screening and treatment for ROP over a period of 10 years at the Specialized Eye Hospital, Varna, Bulgaria.

Materials and methods: Retrospective case note review, between 1996 and 2005, of 686 premature babies screened for ROP in the neonatal unit of the Specialized Eye Hospital, with birth weight below 2050 g and gestational age less than 35 weeks. Those with severe ROP were treated with cryotherapy. In 2001 regular ROP screening rounds were introduced on the neonatal unit. The results for 1996–2000 and for 2001–2005 are compared.

Results: The overall incidence of ROP was 20.8%, increasing from 17.92% in the period 1996–2000 to 23.37% (86 children, 169 eyes) in the second period 2001–2005. The number of babies requiring screening increased from 318 in 1996–2000 to 368 in 2001–2005. The incidence of ROP increased from 17.92% in the first period to 23.37% in the second, but there was no significant difference in the incidence of severe ROP requiring treatment. The unfavorable outcome after treatment, based on early anatomical outcome, decreased significantly during the second period – from 41.56% to 13.51%. The favorable outcome increased during the last 5 years from 71.43% to 90.53%.

Conclusions: The number of babies surviving in our unit has increased as has the incidence of ROP, but our treatment outcomes have improved. Regular screening and earlier treatment are important in improving the outcome for babies with ROP.

Key words: retinopathy of prematurity, screening, treatment, outcomes

INTRODUCTION

Retinopathy of prematurity is one of the major worldwide causes of childhood blindness that is potentially treatable. Blindness rates as a result of ROP vary among different countries and are influenced by the effectiveness of screening, treatment and neonatal care (1). The survival rate of premature infants is increasing due to improvements in neonatal care, and this has increased the requirement for screening and treatment of ROP. Since the publication of the landmark Cryo ROP paper which demonstrated the benefit of treatment, screening for ROP has been undertaken to identify sight threatening disease (2). More recently, the value of early treatment in zone 1 disease has been demonstrated (3). In order for infants to benefit from these findings, there must be an effective screening strategy and understanding of the need for treatment. This requires implementation of an appropriate local screening protocol, with a review of outcomes and knowledge of the latest publications, to produce a dynamic and open screening and treatment program for ROP.

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MATERIALS AND METHODS

We retrospectively reviewed the case notes of all prematurely born babies in the neonatal unit in Varna that underwent screening between January 1996 and December 2005. We excluded patients sent for treatment from other hospitals as in this study we have evaluated our screening and treatment results for inborn babies only. Screening and treatment for ROP in infants born at the Specialized Hospital for Obstetrics and Gynecology has been undertaken by paediatric ophthalmologists from our unit since 1987, but we have only evaluated the last 10 years outcome in this paper.

The screening criteria were birth weight below 2000 g and gestational age less than 34 weeks or bigger and more mature babies with an unstable clinical course, and whom the paediatricians felt required screening. Included in the study were 686 babies with birth weight below 2050 g and gestational age less than 35 weeks. The first examination was performed between 4–6 weeks after birth and more recently has been undertaken on the fourth week after birth. Screening was performed after dilatation of the pupils with tropicamide as phenilephrine and cyclopentolate are not routinely available in our unit, with direct or indirect ophthalmoscopy.

Grading of the severity of ROP was based on the most advanced stage reached according to ICROP guidelines (4, 5). We considered cases of ROP to be severe if they required treatment. Into this group were included cases with threshold and prethreshold (early) treatment of ROP. The indications for early treatment included rapidly progressing ROP, pre-plus posterior disease, and in addition social, technical and organizational factors. Babies with severe ROP received treatment with cryotherapy.

We have compared the results for 1996–2000 and 2001–2005 based on the early anatomical outcome. We have not assessed the functional outcome. The children were observed for a minimum of six months. The criteria for evaluation were the following: favorable was taken as completion of retinal vascularization without noticeable structural retinal changes and unfavorable as traction in the posterior pole or the presence of stage IV or stage V ROP.

Due to the long time period involved in the study, some alterations in practice occurred. Initially babies were screened with direct ophthalmoscopy, but now they are screened using indirect ophthalmoscopy. Previously not all babies had fundal diagrams drawn, so in the older records there is only a description of the retinal findings.

We used the chi square test to compare groups in the two periods. Statistical analysis was performed with SPSS version 11.0.

RESULTS

686 babies were screened during the period 1996–2005. The number of babies requiring screening increased from 318 in 1996–2000 to 368 in 2001–2005.

The overall incidence of ROP was 20.8% (143 children, 281 eyes), increasing from 17.92% (57 children, 112 eyes) in the first period to 23.37% (86 children, 169 eyes) in the second period.

For the period 1996–2000, 28 were boys and 29 girls; for 2001–2005, 49 were boys and 37 girls.

Cryotherapy was performed on 73 eyes (64.03%) between 1996–2000 and 113 eyes (65.07%) in the second period. There was a significant difference in the number of eyes that underwent prethreshold (early) treatment, increasing from 7 eyes (6.14%) during 1996–2000 to 64 eyes (37.21%) for the period 2001–2005 ($p < 0.05$).

The outcome for all eyes with ROP (with or without treatment) was favorable in 71.43% (80 eyes) and increased during the second period to 90.53% (153 eyes) ($p < 0.05$).

Unfavorable outcome for the period 1996–2000 was observed in 28.07% of the eyes with ROP (32 eyes) with different pathological changes including traction involving the macula (11 eyes, 9.82%); partial retinal detachment (6 eyes, 5.36%) and total retinal detachment (15 eyes, 13.39%).

Analysis of the second period shows a significant decrease in unfavorable outcome to 9.47% (16 eyes) with traction involving the macula (8 eyes, 4.73%), partial retinal detachment (1 eye, 0.60%) and total retinal detachment (7 eyes, 4.14%).

The favorable outcome after treatment increased during the last 5 years from 58.44% to 86.49% ($p < 0.05$).

The results are summarized in Tables 1–4.

DISCUSSION

The landmark CryoROP paper confirmed the benefit of treatment for ROP, and more recently the functional and anatomical benefit of early treatment has been demonstrated (2, 3). The incidence of ROP varies in different countries in the world, being least in the highly developed countries and higher in less developed countries. In the poorest countries neonatal care is not sufficiently developed to allow extremely premature infants to survive, hence ROP is not presently a significant health problem. Middle income countries presently have the worst rate of childhood blindness due to this treatable disease. A recent publication has given the incidence of childhood blindness due to a ROP in Bulgaria as 22.9% (1). Along with improvements in neonatal care must come improvements in paediatric ophthalmological management to reduce the risk of blindness in middle-income countries. The lack of awareness of ROP and the lack of skilled, trained personnel to screen and treat premature infants have been identified as reasons for the high rate of blindness in some countries. Improvements in neonatal care are the remit of the neonatologist, but the paediatric ophthalmologist can make a significant impact with a dedicated ROP screening program and prompt treatment for a sight threatening disease.

During the last 5 years there has been a significant increase in the favorable outcome of treatment of ROP in our unit. We have analyzed our management of these babies in the last 10 years to analyze how we have produced this major improvement in outcomes.

Organization of screening. Originally there was no regular screening round, and although babies are meant to be screened four to six weeks after birth, they were often presented late for screening. The institution of a

Table 1. **Incidence of ROP in the two periods**

	1996–2000 No (%)	2001–2005 No (%)
ROP	112 (98.25)	169 (98.26)
No ROP	2 (1.75)	3 (1.74)
Total	114 (100.00)	172 (100.00)

Table 2. **Severity of ROP in the two periods**

	1996–2000 No (%)	2001–2005 No (%)	1996–2005 No (%)
No ROP	2 (1.75)	3 (1.74)	5 (2.10)
ROP 1	17 (14.91)	29 (16.86)	46 (16.08)
ROP 2	15 (13.16)	25 (14.53)	40 (13.99)
ROP 3	51 (44.74)	81 (47.09)	132 (45.80)
ROP 4	15 (13.16)	0 (0.00)	15 (5.24)
ROP 5	0 (0.00)	0 (0.00)	0 (0.00)
ROP zone 1	14 (12.28)	34 (19.77)	48 (16.78)
Total	114 (100.00)	172 (100.00)	286 (100.00)

Table 3. **Therapy of ROP in the two periods**

Therapy	1996–2000 No (%)	2001–2005 No (%)
Pre-threshold	7 (6.14)	64 (37.21)
Threshold	66 (57.89)	49 (28.49)
No therapy	41 (35.96)	59 (34.30)
Total	114 (100.00)	172 (100.00)

Table 4. **Outcome in eyes with ROP**

Outcome	1996–2000 No (%)	2001–2005 No (%)
Regress	80 (71.43)	153 (90.53)
Traction	11 (9.82)	8 (4.73)
Partial retinal detachment	6 (5.36)	1 (0.58)
Total retinal detachment	15 (13.39)	7 (4.14)
Total	112 (100.00)	169 (100.00)

regular screening round by paediatric ophthalmologist has improved the organization. The timing of the first examination is now arranged for four weeks after birth, with regular follow-up arranged by the paediatric ophthalmologist. This has allowed early detection of retinal changes and timely treatment if necessary.

Treatment. During the first period children were brought to the Eye Hospital for treatment which was sometimes delayed if the child was not stable and was unfit for operation. We reorganized this so that the babies were treated not in the eye unit but in the neonatal unit which allowed better monitoring of the babies. Not only is this safer for the infant undergoing treatment, but also it has allowed younger, sicker babies to undergo treatment under the supervision of the neonatal team.

To increase the chances for favorable outcome and based on the information from literature (3) and the results from our previous analysis (8) during the second period we précised the criteria for prethreshold ROP and performed cryotherapy in cases with high risk prethreshold ROP (9). We changed our approach to ROP in zone I considering the high aggressiveness of the disease in this zone (10).

Education. During the years there was an improvement in the neonatal care of premature babies.

During the period 1996–2000, monitoring of SpO_2 was done several times a day just for the babies with birth weight under 1500 g. that were on artificial pulmonary ventilation and the aim was to maintain SpO_2 over 95%.

During the last period the neonatal staff have become more informed about ROP its pathogenesis and prevention. Now efforts are made to maintain SpO_2 up to maximum of 95% saturation. The unit has acquired more equipment (although there is still shortage of necessary equipment) and aims to monitor strictly SpO_2 in all children with birth weight below 1500 g. The role of excessive oxygen in ROP has been recognised for years, but the importance of maintaining steady, lower saturations has become increasingly recognized (6, 7). Regular input from the paediatric ophthalmologist has been vital in alerting the neonatal staff to the importance of oxygen monitoring and the importance of screening and treatment of ROP.

Our results are based on the early anatomical outcome and not on visual outcome. Late complications including decreased visual acuity from anisomeropia, strabismus, amblyopia or other subtle structural changes probably may increase the unfavorable outcome.

CONCLUSIONS

We have shown a significant improvement in our results for ROP treatment between 2001 and 2005, compared to the previous five years, despite an increasing number of babies requiring screening and treatment due to improve survival in our unit. We believe this has been brought about by the institution of a dedicated ROP screening round in the neonatal unit by paediatric ophthalmologist, improved organization of screening and cooperation with the neonatal staff with regard to oxygen monitoring. By these methods we have reduced the number of children in our unit going blind from this treatable disease. We would highly recommend that all neonatal units have a dedicated weekly ROP screening undertaken by an ophthalmologist trained in the identification and treatment of ROP.

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