CLINICAL SPECTRUM OF CONGENITAL CORNEAL STAPHYLOMA: A CASE REPORT

VERSCHOOTEN R, FOETS B*, DE RAVEL T**, VAN GINDERDEUREN R*, LOMBAERTS R***, CASTEELS I**

ABSTRACT

We report the dramatic ophthalmological findings in a newborn baby consisting of a perforated right eye and a protruding buphthalmic opacified left eye. The diagnosis of congenital corneal staphyloma was suspected and was confirmed on histopathological examination of the right eye remnants, and of the left cornea after a corneoscleral keratoplasty was performed. This case report describes one clinical spectrum of Peter's anomaly.

KEYWORDS

Anterior corneal staphyloma
Congenital Corneal staphyloma
Peter's Anomaly

.....

** Departments of Ophthalmology, * Human Genetics** and Paediatrics****
University Hospitals Leuven, Belgium

Submitted: Feb 22, 2011
Accepted: Apr 11, 2011

INTRODUCTION

Congenital corneal staphyloma (CCS) is characterized by ectasia, total corneal opacification and forward protrusion of the eye between the eyelids. It is presumed to be a developmental abnormality characterized by a severely abnormal anterior segment. The condition can be either unilateral or bilateral (1,2). We reviewed the clinical spectrum, pathological features and treatment options of this condition.

CASE REPORT

A newborn girl was delivered by an elective caesarean with the use of a forceps, with a birthweight of 3810 grams. She is the fifth born child to healthy nonconsanguinous parents of African origin. There was no family history of ophthalmological or systemic problems. Antenatal genetic consultation showed a normal 46, XX karyotype.

At birth the right eye was haemorrhagic, the left eye was opacified, protruding and buphthalmic. Examination under general anesthesia revealed an amorphous remnant of an intra-uterine perforated right eye. An implant was inserted after evisceration of this eye remnant. The left eye was hypotonic with an eye pressure of 6 mmHg. The cornea was staphylomatous and cloudy with a corneal diameter of 11 mm (Figure 1). Details of the anterior chamber anatomy and the posterior pole could not be visualized. Ultrasound biomicroscopy of the left eye revealed a deep anterior chamber with adhesions of the peripheral iris to the cornea and a

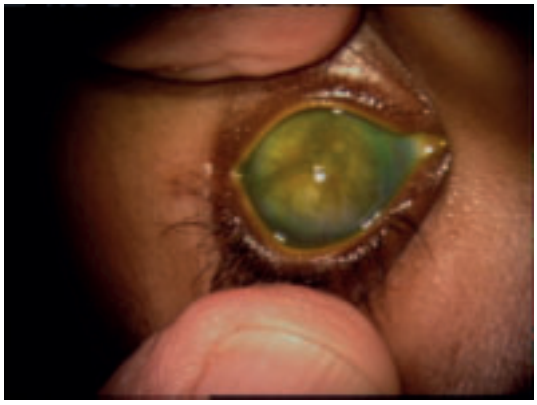

Fig 1. Left eye at birth.

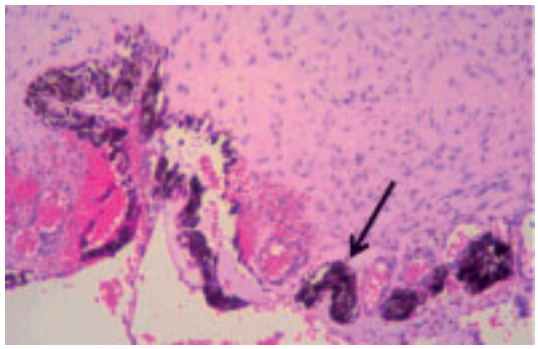

Fig 2. Histopathologic examination of the eviscerated right eye. Note the pigmented uvea cells at the posterior border of the cornea (arrow).

normal lens. There was no retinal detachment. Histopathological examination of the right eye remnants showed the absence of corneal Descemet's membrane, Bowman's layer and endothelium. The stromal lamellae were irregularly formed with posterior vascularization and infiltration of neutrophil granulocytes. Undifferentiated strands of iris and ciliary body were attached to the posterior surface of the cornea. The epithelium was intact (Figure 2). Systemic examination of cardiovascular, respiratory and central nervous system was normal. Abdominal ultrasound showed a hypoplastic right kidney with normal corticomedullary differentiation. At the age of 2 months, a custom-made corneoscleral prosthesis was implanted in the right orbit, in order to enable normal development of the orbit with better cosmetic effect. Flash electroretinogram at the age of 5 months revealed a minimal single cone response and a minimal maximal combined response on the left eye. DNA examination showed no mutations in the beta1,3-glucosyltransferase (*B3GALTL*), *PITX2* and *FOXC1* genes.

At regular intervals, examinations under anesthesia were performed. The left cornea progressively became more staphylomatous, opaque and thinned with a corneal diameter of 16 mm (Figure 3). At the age of 10 months, because of the risk of perforation, it was decided to proceed with a corneoscleral transplantation, consisting of an 16 mm donor button, and lensectomy. The patient's cornea was excised in a free-hand fashion. On fundoscopy, optic disc and posterior pole were found to be completely normal. To prevent a graft failure, systemic

Fig 3. Left eye at the age 6 months.

immuno-suppressive therapy consisting of Tacrolimus, Prednisolone and Azathioprine was started. Histologic sections of this cornea showed findings comparable with the right eye. The cornea initially became progressively clearer, the baby developed visual contact with perception of light and objects. Unfortunately, after two months, the eye became hypotonic and pthysis was inevitable after three months.

DISCUSSION

This case represents a bilateral congenital corneal staphyloma consistent with a severe form of Peter's anomaly (PA), confirmed by the histopathological examination of both eyes. The cause of PA is only known in a minority of cases. Genetic and environmental factors play a role in the pathogenesis of PA. The critical event is thought to occur in the first trimester of pregnancy during the development of the anterior chamber. Secondary angle closure glaucoma resulting from total anterior synechiae, usually leads to gradual bulging of the cornea (1,2). The histopathologic examination of CCS reveals corneal ectasia with the posterior surface lined by remnants of an atrophic iris. The corneal epithelium is intact but keratinization secondary to exposure is present. The corneal stroma is hypercellular, vascularized and disorganized. Typically, Descemet's membrane, Bowman's layer and endothelium are absent. Except for changes due to concomitant glaucoma, the posterior segment is normal (2). PA is variable in appearance and severity, and it is hypothesized to represent a spectrum of congenital anomalies (3). Considering the histopathologic similarities between CCS and PA, CCS could be a more severe subtype of mesenchymal dysgenesis as compared to PA (1). In literature two different types of PA are described (2). In type I, there is a central corneal opacity with adherent strands from the iris. This opacity is caused by a defect in the underlying corneal endothelium and Descemet membrane. The lens is clear and is in normal position. In type II, in addition to the corneal changes and synechiae, the lens is cataractous and is adherent to the posterior cornea. Association with other ocular and systemic malformations has been described (2). Most cases of PA are sporadic or autosomal recessive. They are rarely autosomal dominant. Isolated PA may be caused by mutations in *PAX 6*, *RIEG1*, *PITX 3*, *FOXC1* and *CYP1B1* genes (4,5). Mutations in both *PAX6* and *PITX2* genes are known to cause PA following an altered neural crest development. The neural crest mesenchyme gives rise to the anterior stroma, including Bowman's membane, and also to the posterior stroma, Descemet's membrane, and the endothelium. Thus, failure of neural crest cell migration may result in both anterior and posterior segment maldevelopment (5). PA may be associated with microphthalmos, posterior embryotoxon, sclerocornea, iris coloboma, aniridia and persistent hyperplastic primary vitreous. Glaucoma develops in up to 60% of cases (6). PA is usually isolated, but can be associated with systemic anomalies, the incidence being higher when corneolenticular adhesion is present (6). They include growth retardation, cleft lip/palate, conotruncal anomalies of the heart, ear anomalies, central nervous system anomalies, facial anomalies, laryngomalacia or macroglossia (6). Genitourinary abnormalities, as renal hypoplasia, hydronephrosis, renal and ureteral duplication, multicystic dysplastic kidney and glomerulocystic kidney, are reported in about 10-19% of patients with PA. Embryogenetic stages of eye and kidney development occur simultaneously. From the 7th to 10th week, the development of ocular architecture and the differentiation of kidney tubules progress in parallel (4,7). In our patient a hypoplastic right kidney was diagnosed. Peters plus syndrome, following an autosomal recessive pattern of inheritance, is character-

ized by genitourinary abnormalities, syndactyly, and brachycephaly. Also cardiac, neural and hearing abnormalities are seen (5). Mutations in *B3GALTL* gene were identified in patients with typical Peters Plus syndrome, while no mutations were found in patients that demonstrated some but not all of the characteristics (8).

Management of infants with severe CCS is difficult and challenging. Penetrating keratoplasty (PKP) can be successful in milder forms of this disorder, but graft failure is common in severe cases. In a cohort of 47 patients (72 eyes), Yang and colleagues described that the long-term probability of maintaining a clear graft after initial PKP was only 35% with subsequent grafts rarely surviving (9). They also reported that after a PKP, 70% of eyes with intraoperative lensectomy /vitrectomy and 75% of eyes with severe disease (presence of corneo-lenticular adhesions and/or a corneal staphyloma) developed no vision or only light perception (9). Independent risk factors for poor visual acuity outcome were the presence of stromal vascularization and the use of a donor corneal button of 8 mm or more (9). Because of the severe staphylomatous and thinned cornea in our patient, a large donor corneal button with a lensectomy was the only option. Unfortunately, we were unable to prevent a graft failure. Luckily the right eye, treated by evisceration with primary implantation and prosthesis insertion, produced a cosmetically successful result without complications, as reported by Kim and colleagues (10).

REFERENCES

(1) Leff SR, Shields JA, Augsburger JJ, Sakowski AD, Blair CJ – Congenital corneal staphyloma: clinical, radiological, and pathological correlation. Br J Ophthalmol 1986; 70(6):427-430.

(2) Zaidman GW, Juechter K – Peters' anomaly associated with protruding corneal pseudo staphyloma. Cornea 1998; 17(2):163-168.

(3) Miller MM, Butrus S, Hidayat A, Wei LL, Pontigo M – Corneoscleral transplantation in congenital corneal staphyloma and Peters' anomaly. Ophthalmic Genet 2003; 24(1):59-63.

(4) Weisschuh N, Wolf C, Wissinger B, Gramer E – A novel mutation in the FOXC1 gene in a family with Axenfeld-Rieger syndrome and Peters' anomaly. Clin. Genet 2008; 74(5):476-480.

(5) Maillette de Buy Wenniger-Prick LJJM, Hennekam RCM – The Peters' plus syndrome: a review. Ann. Genet 2002; 45(2):97-103.

(6) Ozeki H, Shirai S, Nozaki M, et al – Ocular and systemic features of Peters' anomaly. Graefe's Archive for Clinical and Experimental Ophthalmology 2000; 238(10):833-839.

(7) Tuli N, Kumar S, Sood S – Peters plus syndrome and absence of kidney: a case report. Cases J 2009;2(1):2.

(8) Reis LM, Tyler RC, Abdul-Rahman O, et al – Mutation analysis of B3GALTL in Peters Plus syndrome. Am. J. Med. Genet. A 2008; 146A(20):2603-2610.

(9) Yang LLH, Lambert SR, Drews-Botsch C, Stulting RD – Long-term visual outcome of penetrating keratoplasty in infants and children with Peters anomaly. J AAPOS 2009; 13(2):175-180.

(10) Kim MJ, Choung HK, Kim NJ, Khwarg SI – Congenital corneal staphyloma treated by evisceration and primary implant placement: 3 cases. Can. J. Ophthalmol 2008; 43(1):111-113.

.....

Address of Correspondence:
IK CASTEELS (R Verschooten)
University Hospitals Leuven
Department of Ophthalmology
Kapucijnenvoer 33
3000 Leuven
BELGIUM
E-mail address: ingele.casteels@uz.leuven.be
(roel_verschooten@hotmail.com)
Tel: 016/332660