weakly correlated with the reopening pressure ($r = 0.412$, $p = 0.042$), and the normal saline guttae were correlated not with the opening pressure ($r = -0.387$, $p = 0.101$), but rather with the reopening pressure ($r = -0.874$, $p < 0.001$). Among the 19 patients, tube ligation (Kee 2001) was performed simultaneously with AGV implantation in two patients due to an intraoperative shallow anterior chamber.

In another 17 patients, excluding the above two patients with tube ligation (mean age, 52.9 ± 17.7 years; 13 men, four women; preoperative mean IOP, 41.8 ± 9.5 mmHg; day 1 postoperative mean IOP, 9.6 ± 5.4 mmHg) the reopening pressure and day 1 postoperative IOP showed a strong positive correlation ($r = 0.715$, $p = 0.001$) and the normal saline guttae correlated negatively with the day 1 postoperative IOP (Pearson’s correlation, $r = -0.742$, $p = 0.001$). Among the five patients with low (level-1) reopening pressure, four patients (80%) experienced hypotonic maculopathy ($n = 1$), shallow anterior chamber ($n = 2$) or choroidal effusion ($n = 1$). Hypotonic maculopathy and choroidal effusion regressed spontaneously. However, in two cases of anterior chamber shallowing, viscoelastic injection was required to resolve an iridocorneal touch.

We suggest that careful subjective grading of the reopening pressure (when priming the tube) by an experienced surgeon is helpful in predicting early postoperative hypertonic complications. In addition, tube ligation may be useful to prevent hypotony-associated complications (Kee 2001). To confirm this possibility, a study with a larger patient population is necessary.

References


Characterization of the biological antioxidant potential in the vitreous fluid from patients with rhegmatogenous retinal detachment

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Editor,

Oxidative stress has been reported to cause cellular damage and play a role in triggering programmed cell death. In many vitreoretinal disorders, including proliferative diabetic retinopathy (PDR) (Yokoi et al. 2007), age-related macular degeneration (Rattner & Nathans 2006) and retinitis pigmentosa (Berson 1996), oxidative stress has been implicated in the development of retinal cellular damages (Carmody et al. 1999). Cederlund et al. (2013) previously reported an elevated vitreous level of oxidative stress biomarkers in their small group of patients with rhegmatogenous retinal detachment (RRD), in addition to showing that oxidative stress was related to the RRD severity. Research has also shown that antioxidant treatments can reduce photoreceptor cell death in experimental retinal detachment in animal models (Rostein et al. 2003). The results of these studies indicated that oxidative stress may play an important role in photoreceptor cell death in RRD. Our current study attempted to characterize the biological antioxidant potential (BAP) in the vitreous fluid of RRD by comparing the BAP in the vitreous fluid collected from patients with various vitreoretinal disorders including RRD and then statistically analysing the BAP in relation to the clinical features of RRD.

This study was approved by the Institutional Review Board of Hiroasaki University Graduate School of Medicine. Undiluted vitreous fluid was obtained at the time of vitrectomy from RRD ($n = 45$), PDR ($n = 93$), retinal vein occlusion (RVO, $n = 14$), epiretinal membrane (ERM, $n = 18$) and macular hole (MH, $n = 24$) patients. Biological antioxidant potential (BAP) values were determined by measuring the reducing potential determined by the conversion of Fe$^{3+}$ to Fe$^{2+}$ in thiocyanate solution (FREE™, Wismerll, Tokyo). Clinical features of RRD were analysed by examining medical records for the extent of the detachment, duration of symptoms, presence of proliferative vitreoretinopathy (PVR) or vitreous haemorrhage (VH), macular status (on or off), and patient age. Biological antioxidant potential values ($\mu$M) were 1860.50 ± 470.50 in RRD, 1647.76 ± 460.53 in PDR, 1863.14 ± 413.76 in RVO, 2169.23 ± 594.01 in ERM and 2258.83 ± 450.79 in MH, respectively. Rhegmatogenous retinal detachment (RRD) exhibited a significantly lower BAP value than MH (ANOVA with post hoc Dunnett’s T3 test, $p = 0.012$), while PDR had a significantly smaller BAP than ERM.
Pearson's correlation coefficient of
and the extent of the detached area, with
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clinical features, BAP values for the
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2 quadrants (2006.59 ± 401.17) were
significantly greater than that extended
over 3 quadrants (1568.33 ± 474.82,
Student’s t-test, \(p = 0.002\)). In addition,
there was a statistically significant nega-
tive correlation between the BAP values and the extent of the detached area, with
a Pearson’s correlation coefficient of
\(-0.384 (p = 0.008), R_1\) in Fig. 1). Fur-
thermore, when the BAP values of the
MH group were used as the controls (0
quadrant), there was an even stronger
correlation, with a Pearson’s correlation coefficient of
\(-0.484 (p < 0.001), R_2\) in Fig. 1).
There were no significant cor-
relations noted between BAP and any
other features examined.
Current results suggest that signifi-
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present in RRD compared to MH. Of the
possible clinical features that could
influence BAP in RRD, only the extent of the
detachment was significantly corre-
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haemoglobin. Thus, antioxidiant treat-
ments may be of benefit in retarding
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References

Berson EL (1996): Retinitis pigmentosa:
unfolding its mystery. Proc Natl Acad Sci
USA 93: 4526–4528.
Carmody RJ, McGowan AJ & Cotter TG
(1999): Reactive oxygen species as mediators
of photoreceptor apoptosis in vitro. Exp Cell
Cederlund M, Ghosh F, Annér K, Andréasson
S & Akerström B (2013): Vitreous levels of
oxidative stress biomarkers and the radical-
scavenger z1-microglobulin/A1M in human
rhegmatogenous retinal detachment. Graefe's
Rattner A & Nathans J (2006): Macular degen-
eration: recent advances and therapeutic
Rostein NP, Politi LE, German OL & Girotti R
(2003): Protective effect of docosahexaenoic
acid on oxidative stress-induced apoptosis of
retina photoreceptors. Invest Ophthalmol Vis
Yokoi M, Yamagishi S, Saito A et al. (2007):
Positive association of pigment epithelium-
derived factor with total antioxidant capacity
in the vitreous fluid of patients with prolifer-
avtive diabetic retinopathy. Br J Ophthalmol
91: 885–887.

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A novel c.2T>A NDP
missense mutation in a
Chinese family with Norrie
disease
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University People’s Hospital, Beijing,
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doi: 10.1111/aos.12904

Editor,
Norrie disease (ND) is a rare X-
linked recessive disorder charac-
terized by bilateral congenital blindness
in males due to deficient sprouting of the
retinal vascular plexus during eye deve-
lopment. The majority of patients suffer
from sensorineural hearing loss with an
onset in childhood or early adulthood.
Approximately 30–50% of patients show
some degree of cognitive retardation.
The Norrie disease pseudoglioma gene
(NDP), located on chromosome Xp11.4,
deries ND. This gene
encodes norrin that plays a critical role
in retinal vascular development (Xu
et al. 2004). Numerous NDP gene vari-
ants from several countries in various
ethnic populations are reported in ND.
We accepted a Chinese family with
ND with alterations in the NDP gene by
molecular genetic testing and identified
a novel mutation responsible for ND. A
7-year-old boy was referred to our
department to our clinic because of the
impaired vision in both eyes since child-
hood. He had normal reference psy-
chomotor development and normal
hearing ability. His right eye had leu-
koma of cornea and retina was invisible.
The left eye had clear cornea with deep
chamber and transparent lens. Fundus
examination revealed retinal detach-
ment and absence of visible retinal
vascular (Fig. 1A,B). Ultrasound B-
scan showed complete retinal detach-
ment in right eye and tractional retinal
detachment in the left eye (Fig. 1C,D).
His 4-year-old brother failed to follow
moving light stimuli after birth. Both of
his eyes had opaque cornes, posterior
synechiae and dense secondary cataract.
We examined the eyes of their parents,
both of them are normal, and other
family members we investigated do not
have impaired vision.
Sequence analysis of the NDP gene in
the elder brother revealed a hemizy-
gous variant at nucleotide position
c.2T>A in exon 2, resulting in a
missense mutation p.Met1Lys
(Fig. 1E). Given this information, we
tested NDP gene exon 2 of younger
brother and their parents. His brother
also carried this hemizygous variant
(Fig. 1F) and the mother was heterozy-
gous for the mutation (Fig. 1G).
But this mutation was absent in his
father (Fig. 1H). The present ND family
shows a distinct genetic defect with a
missense mutation at codon 2 of exon 2
of the NDP gene.

Fig. 1.
Correlation between BAP and the extent of detachment. BAP is significantly
 correlated with the extent of the detachment in the RRD group (closed circle, \(R_1 = -0.384, p = 0.008\), Pearson’s correlation coefficient).
When BAP in the MH group is used as the
control (= 0 quadrant, open circle), there is a
significantly greater correlation between the
BAP and the extent of the detachment
\(R_2 = -0.484 (p < 0.001)\).

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