Suprachoroidal Hemorrhage

BY BRIAN LITTLE, MA, FRCS, FRCOPHTH, FHEA

W e surgeons all eventually have at least one case that haunts us. This one still makes me shudder more than 10 years after it happened, which was not long after I was first appointed as consultant. To add insult to injury, the entire event was faithfully recorded on video, so it can be used in perpetuity by future generations of ophthalmologists. I currently use it regularly myself to illustrate the potentially devastating consequences of failing to respond to the early warning signs of impending disaster.

Above all in such cases, we must learn to swallow our pride, which can stick in our throats. Then, we must try to learn something constructive from our experience. Although we chose to become surgeons and not psychologists, we have to accept that we are subject to the same laws as all other mortals when it comes to understanding how we learn and how we behave under stressful conditions.

THE CASE

The case involved a blinding intraoperative suprachoroidal hemorrhage in the eye of an 82-year-old retired lawyer during otherwise uneventful, “routine” phacoemulsification. The surgery was performed under my supervision by a senior resident, and no preoperative clinical features had suggested a particularly high-risk case. Everything was going according to plan until the later stages of cortical removal. Just as the senior resident was polishing off the last few strands of a central plaque on the posterior capsule, fairly forceful and persistent shallowing of the chamber developed. There was some spontaneous expulsion of the cohesive viscoelastic around the I/A tip, and the posterior capsule bulged through the capsulorhexis. After discerning elevated tension (in more than one sense) and exiting the eye, the senior resident deepened the chamber with a cohesive ophthalmic viscosurgical device (OVD), which remained in the eye this time, because the self-sealing wounds had all now closed. Next came the fateful decision as to whether or not to complete the surgery, which required only the insertion of the lens implant. We discussed this, all too briefly, and decided to “just slip in the IOL”—at that time, a foldable three-piece acrylic lens requiring forceps delivery. The choice did not seem unreasonable, but it became the first spiral in a downward vortex of surgical doom.

During the implant’s delivery through the (enlarged) wound, the majority of the OVD came straight out of the eye, and the chamber shallowed. The senior resident then pronated one hand and opened the forceps in an attempt to rotate the lens and release the optic into the bag. The bulging, drum-skinned posterior capsule was torn by the edge of the folded optic, and vitreous then prolapsed around the lens as it was released.
BSS PLUS®
Sterile Intraocular Irrigating Solution

DESCRIPTION: BSS PLUS® is a sterile intravitreal irrigation solution for use during all intraocular surgical procedures, including those requiring additional intraocular perfusion time (e.g., pars plana vitrectomy, phacoemulsification, extracapsular cataract extraction, anterior segment reconstruction, etc.). The solution does not contain a preservative and should be prepared just prior to use in surgery.

Part I: Part I is a sterile 480 mL solution in a 500 mL single-dose sterile vial for use as an intraocular irrigation solution for Part II. Each mL of Part I contains: sodium chloride 7.14 mg, potassium chloride 0.38 mg, sodium bicarbonate 2.1 mg, dextrose 0.92 mg, hydrochloric acid and sodium hydroxide (to adjust pH), in water for injection.

Part II: Part II is a sterile concentrate in a 20 mL single-dose sterile vial for use in Part I. Each mL of Part II contains: calcium chloride dibasic 3.03 mg, magnesium chloride hexahydrate 5 mg, dextrose 4.6 mg, sodium chloride 7.14 mg, sodium bicarbonate 2.1 mg, dextrose 0.92 mg, hydrochloric acid and sodium hydroxide (to adjust pH), in water for injection.

After addition of BSS PLUS Part II to the Part I bottle, each mL of the reconstituted product contains: sodium chloride 7.14 mg, potassium chloride 0.38 mg, sodium bicarbonate 2.1 mg, magnesium chloride hexahydrate 0.12 mg, sodium dihydrogen phosphate 0.42 mg, sodium bicarbonate 2.1 mg, dextrose 0.92 mg, glutathione disulfide (oxidized glutathione) 0.184 mg, hydrochloric acid and sodium hydroxide (to adjust pH), in water for injection. The reconstituted product has a pH of approximately 7.4. Osmolarity is approximately 305 mOsm.

CLINICAL PHARMACOLOGY: None of the components of BSS PLUS® are foreign to the eye, and BSS PLUS® has no pharmacological action. Human perfused cornea studies have shown BSS PLUS® to be an effective irrigation solution for preserving corneal endothelium and maintaining corneal endothelial integrity during intraocular perfusion. As a result of studies in rabbit, it has been shown that BSS PLUS® is associated with less corneal edema and the maintenance of the central pupil, thereby decompressing the eye. By now, a tissue damage could result if other drugs are added to product.

INDICATIONS AND USAGE: BSS PLUS® is supplied in two packages for intravitreal irrigation because BSS PLUS® contains the appropriate bicarbonate, pH, and ionic composition necessary for the maintenance of normal retinal neural activity. Human and animal studies have demonstrated BSS PLUS® to be safe and effective when used during surgical procedures such as pars plana vitrectomy, phacoemulsification, extracapsular cataract extraction, anterior segment reconstruction. No differences have been observed between sterile and partially-patient following use of this drug product.

ADVERSE REACTIONS: No adverse effects attributable to the use of BSS PLUS have been reported. Their relationship to the use of BSS PLUS has not been established.

OVERDOSE: The solution has no pharmacological action and thus no potential for overdosage. However, as with any intraocular surgical procedure, the duration of intravitreal manipulation should be kept to a minimum.

DISPENSATION: The solution has no pharmacological action and thus no potential for overdosage. However, as with any intraocular surgical procedure, the duration of intravitreal manipulation should be kept to a minimum.

CONTRAINDICATIONS: There are no specific contraindications to the use of BSS PLUS. However, contraindications for the surgical procedure during which BSS PLUS is to be used should strictly adhere to.

WARNINGS: The solution has no pharmacological action and thus no potential for overdosage. However, as with any intraocular surgical procedure, the duration of intravitreal manipulation should be kept to a minimum.

PRECAUTIONS: DO NOT USE BSS PLUS UNTIL PART I IS FULLY RECONSTITUTED WITH PART II. Do not use undiluted. BSS PLUS does not contain a preservative, therefore, do not use this container for more than one patient. Do not use additives other than BSS PLUS Concentrate Part I (20 mL) with this product.

Tissue damage could result if other drugs are added to product.

DOSED AND ADMINISTRATION: The solution should be used in its unopened sterile vials. The solution should be used immediately following reconstitution. When complete, the solution is intended for use in ophthalmic surgery. Do not use an irrigation solution that has been previously used. It should be used as a single-use product for up to 3 hours after reconstitution. After that time, discard the solution.

Before each use, the eye should be thoroughly irrigated with normal saline or Balanced Salt Solution to remove any residual of previously used irrigation solution.

How supplied: BSS PLUS® is supplied in two packages for intravitreal irrigation purposes (see following). BSS PLUS is reconstituted with 20 mL of Part I and is used as a single-use product.

Storage: Store Part I and Part II at 2°C to 8°C (36°F to 46°F) for up to 1 year, or at room temperature for up to 30 days. Do not refrigerate or freeze. Do not exceed 1 year from date of manufacture. Do not use if vial has been opened.

DOSED AND ADMINISTRATION: The solution should be reconstituted with 20 mL of Part I and is used as a single-use product.

Figure 2. After the IOL’s removal, the iris is incarcerated in the wound, and a suprachoroidal hemorrhage extends across the central pupil.

Figure 3. After an anterior vitrectomy, a suprachoroidal hemorrhage extends almost completely across the pupil.

From the forceps, although this was not recognized when it happened. All attempts to deepen the chamber resulted in iris prolapse out of the sideport incision. To make things worse, the implant was now pressed flat up against the corneal endothelium, and a grey reflex was becoming apparent from the periphery (Figure 1).

I took over the surgery and immediately experienced a deeply uncomfortable epiphany: I had never before been faced with this situation, but I bore full responsibility for deciding how to proceed. I rushed ahead and decided that, in order to save the cornea, I would enlarge the incision and remove the implant. My mistake seems glaringly obvious now, but most of us can probably appreciate that nothing ever seems so self-evident down the microscope when we are under duress as it does when we view it through the "retrospectoscope" in the calm light of day.

Out came the implant ... and vitreous ... and iris. Anterior vitrectomy instruments available at that time were coaxial and were used through the main incision. They caused the wound to gape and the incision to leak, both of which washed more vitreous out through the wound while lowering the IOP to atmospheric pressure, thereby decompressing the eye. By now, a grey reflex had begun to extend posteriorly, reflecting the steady flow of subretinal blood tracking back to the macula (Figure 2). I finally closed the main wound and sutured it with great difficulty. Because I could not push or pull it back inside the eye, I excised the iris that had prolapsed through the sideport incision.

At this point, half an hour after I took over the case, the grey reflex had tracked back under the macula, and virtually the entire red reflex was greyed out (Figure 3).
The deathblow came when I had to release some incarcerated iris strands from the main wound. I swept them in centrally using a cyclodialysis spatula through the sideport incision. The traction required for this maneuver was sufficient to rupture an iris root vessel. I have not yet mentioned that the patient was taking anticoagulants for atrial fibrillation! Fairly brisk and profuse bleeding ensued before I could staunch the flow, and much of it, of course, gravitated back into the vitreous cavity.

I had turned a complication into a catastrophe, ending up with a suprachoroidal hemorrhage that tracked under the macula, a vitreous hemorrhage, and a hyphema (Figure 4).

THE OUTCOME

My next duty was to inform the patient and his family what had happened as soon as possible with a clear and unambiguous explanation. Although we surgeons naturally want to offer the possibility of a positive outcome, in this situation, it would have been misleading, because the visual prognosis was uniformly wretched. This case presents one of very few complications for which removing all hope is the only honest option, although a distinctly uneasy one. They understood exactly what had happened and were disarmingly accepting to the point of expressing their gratitude for the explanation. The patient himself was unusually philosophical and accepted this outcome as “one of those things that happens.” He ended up with light perception in this eye. Fortunately, his other eye had reasonably good vision with only an early cataract.

Figure 4. An iris root hemorrhage after internal sweeping of the incarcerated iris out of the wound.

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PROTECTION AND SAFETY WITH BSS PLUS®

- Provides corneal detumescence
- Maintains corneal endothelial integrity
- Appropriate composition necessary for the maintenance of normal retinal electrical activity

IMPORTANT SAFETY INFORMATION

Warning
- For irrigation during ophthalmic surgery only. Not for injection or intravenous infusion.
- Do not use unless product is clear, seal is intact, vacuum is present and container is undamaged. Do not use if product is discolored or contains a precipitate.

Precautions
- Do not use BSS PLUS® until Part I is fully reconstituted with Part II. Discard unused contents.
- BSS PLUS® does not contain a preservative; therefore, do not use this container for than one patient. Do not add additives other than BSS PLUS® Concentrate Part II (20 mL) with this product.
- Tissue damage could result if other drugs are added to the product.
- Discard any unused portion six hours after preparation.

Please see full prescribing information.

1. BSS Plus® product insert. Please see full prescribing information. © 2009 Alcon, Inc. 85243-1
THE LESSONS

I learned a lot from this disaster. It was a deeply upset-
ting experience for all involved, and I felt directly responsi-
ble for what had happened. I reflected in great detail on
the sequence of events in order to understand what pre-
cisely had happened, why it had happened, whether it
could have been avoided, and if it could be avoided in the
future.

It was clear that, because of my inexperience with
intraoperative suprachoroidal hemorrhages, I had been
slow to recognize and react appropriately to the early
signs that it was happening. Spontaneous expulsion of an
OVD from the chamber combined with flattening of the
anterior chamber can safely be assumed to be a supra-
choroidal hemorrhage until proven otherwise. If we sus-
pect this complication, we should close the eye immedi-
ately and then take a calm look with the binocular indi-
rect ophthalmoscope. If the view is poor, a B-scan ultra-
sound is always helpful. Whether our suspicion is right or
not, the consequence is the same in that we come back
after a delay and complete the surgery, and we can then
expect a good result. No advanced technical skills are
needed to sort this out. In this case, I should have re-
mained calm, assessed the situation, and considered the
available options before deciding on the best plan of
action. This is an issue of mindset and has nothing to do
with surgical skills, although it is at the heart of what
makes a good surgeon.

COGNITIVE SKILLS

Information Gathering

My case demonstrates the impact of our cognitive skills
on the surgical outcome. The first signs of trouble were a
shallowing chamber and the OVD’s expulsion during pol-
ishing of the posterior capsule. Our first step should be to
take in this information and acknowledge that something
is definitely not right. Next, we need to act on this infor-
mation and try to identify possible causes.

Assessment of the Situation

We know that there are a limited number of causes of
positive pressure, including pressure from the speculum,
posterior misdirection of irrigating fluid, a delayed
retrobulbar hemorrhage, a large volume of peribulbar
or retrobulbar anesthetic, a suprachoroidal hemorrhage,
and maybe a full and heavy drainage pouch on the
drape. Our next step is to compare the predicted be-
behavior of each of the differentials with the observed
behavior of the case. The forceful shallowing was of late
and rapid onset, and it was persistent once it devel-
oped, which pretty much rules out all of the differen-
tials except for a suprachoroidal hemorrhage.

Decision Making

Finally, we must devise a plan of action that respects
the core principle of doing what is safest and best for
the patient. It will vary widely depending on our level of
surgical experience, our degree of confidence about
dealing with a rare acute event, the availability of cor-
rect instruments and equipment, the presence of expe-
rienced scrub staff, etc. The correct decision may well
be to do nothing at this point in time. We may decide
to close up the eye, explain to the patient that this was
the safest option that is likely to get him or her the best
end result, and make an appropriate referral. There is
absolutely no shame in taking this course of action;
rather, it demonstrates that we have the self-discipline
and humility to put the patient’s interests before our
own. Neither is there any harm in giving ourselves more
time, if we need it, to fully assess the situation. As
Thomas Jefferson said so succinctly, “Delay is preferable
to error.”

In this case, doing nothing would have been exactly
the right action to take with a suspected suprachoroidal
hemorrhage. I should have hydrated the wounds to
close them and pressurized the eye to tamponade the
hemorrhage. In 10 days, the blood would have liquefied
and been reabsorbed, and I could have completed the
surgery.

CONCLUSION

Few of us are taught cognitive skills during our train-
ing, but they are invaluable in both avoiding and deal-
ing with complications. With the recent development
of surgical simulators, I hope that cognitive skills train-
ing will be incorporated into residency programs so
that young surgeons may prepare for rare complica-
tions such as suprachoroidal hemorrhages without
exposing a patient’s eye to risk. I have undeniably
learned from my mistakes, but it is such a shame that
someone lost the sight in one eye at the start of my
learning curve.

My patient did not come back to me for cataract
surgery on his second eye, despite his philosophical
and forgiving attitude. Who can blame him?

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