Warfarin anticoagulation is often required for the treatment of potentially life-threatening diseases such as atrial fibrillation or deep vein thrombosis or for patients who have undergone surgical implantation of prosthetic cardiac valves. Cessation of anticoagulation therapy may be associated with an increased risk of embolic disease and stroke, events that can result in severe morbidity and even mortality. When contemplating surgical intervention, however, vitreoretinal surgeons may be appropriately concerned that maintenance of anticoagulation can be associated with an increased risk of operative or postoperative hemorrhage. Therefore, vitreoretinal surgeons face a dilemma: should anticoagulation be maintained, modified, or discontinued in anticipation of surgery?

To answer this question, we conducted a retrospective study to inquire if there is a relative risk associated with cessation of warfarin anticoagulation, to estimate the risk of vitreoretinal surgery while maintaining warfarin anticoagulation, and to learn if it is appropriate to modify anesthetics or surgical techniques when dealing with anticoagulated patients. This article reviews the literature and discusses the results of our study.

**Literature**

A review of the literature is helpful in assessing the risk of cessation of anticoagulation. Data from the European Atrial Fibrillation Trial Study Group indicate that patients who have nonrheumatic atrial fibrillation experience a 4.2% risk per year of cerebrovascular accident (CVA). Among those patients whose anticoagulation therapy is continued, the risk of recurrent CVA was estimated to be 6% to 8% over the ensuing 2 to 3 years. However, the risk of recurrent CVA was found to increase to 9% to 13% annually in patients whose anticoagulation therapy was discontinued.

In a report to the American Intraocular Implant Society, Stone et al surveyed 105 physicians who discontinued warfarin in anticipation of surgery. Those physicians reported that, among their patients, there were six who experienced CVAs, resulting in 2 deaths; there were also 7 nonfatal thromboembolic events. It should be noted that even though therapy was discontinued, surgical hemorrhagic complications still occurred in some patients. Among respondents who maintained warfarin anticoagulation, no hemorrhagic complications were described. Moll et al reviewed the experience of 57 physicians who had discontinued anticoagulation and reported nine thromboembolic events, including 2 deaths and 3 patients with residual significant neurologic deficits.

Vitreoretinal surgery can be safely performed while maintaining warfarin anticoagulation in many patients.

**By M. Gilbert Grand, MD**

**Figure 1. Massive postoperative orbital hemorrhage.**

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In a prospective study of 1626 patients who experienced deep vein thrombosis and/or pulmonary embolic disease and for whom anticoagulation was discontinued, there was a 23% risk of recurrent venous thromboembolism. Based on these data, it is reasonable to conclude that the risk of cessation of anticoagulation is real. The constellation of data seems to indicate that cessation is associated with an increased number of thromboembolic events, many of which are associated with significant morbidity or mortality. The mechanism for this is uncertain, but it is speculated that there may be a rebound hypercoagulable state following cessation of anticoagulation therapy. It is paradoxical and disconcerting that, despite discontinuation of anticoagulation, surgeons still experienced hemorrhagic complications in the surgical management of their patients.

RETROSPECTIVE REVIEW

Hoping to answer the question regarding the relative risk of maintaining anticoagulation during vitreoretinal surgery, we conducted a retrospective review of patients who underwent vitreoretinal surgery while maintaining anticoagulation with warfarin. We identified 54 patients who underwent a total of 57 surgical procedures. We divided them into groups based on the degree of anticoagulation as measured by their international normalized ratio (INR) obtained the morning of surgery.

Of the 54 patients, 25 were anticoagulated because of underlying atrial fibrillation, eight for prosthetic valves, eight for deep vein thrombosis, and 13 for the management of other vascular problems. The indications for vitreoretinal surgery were primarily the repair of retinal detachment or media opacity due to chronic vitreous hemorrhage. Many patients underwent surgery for management of epiretinal membranes, macular holes, or other vitreoretinal pathologies. These patients were divided into 2 major subgroups: the subtherapeutic group (INR ranged from 1.2 to 1.99) and the therapeutic group (INR ≥2.0).

RESULTS

We performed 38 vitreoretinal procedures in the subtherapeutic group. All 38 eyes underwent pars plana vitrectomy, and three underwent concomitant scleral buckling. Local anesthesia was used in 29 patients, and general anesthesia was used in nine patients. No patients experienced anesthetic hemorrhagic complications or intraoperative bleeding. Two patients had vitreous hemorrhage postoperatively, but both improved spontaneously, and no patients required reoperation.

We performed 19 vitreoretinal procedures in the therapeutic group. Nineteen eyes underwent vitrectomy, and 5 had concomitant scleral buckling. Local anesthesia was used in 15 patients, and general anesthesia was used in 4. There were no anesthetic hemorrhagic complications, and no patients experienced intraoperative bleeding. The 2 patients who had postoperative hemorrhages showed spontaneous improvement. None of the patients within this group required reoperation.

Overall, visual improvement was substantial in both groups of patients.

DISCUSSION

There is substantial evidence in the ophthalmic literature indicating that cataract surgery can be safely performed without risk of intraoperative or postoperative complication while maintaining anticoagulation. However, there are relatively few reports regarding the results of vitreoretinal surgery in anticoagulated patients. McCormack et al performed eight vitreoretinal procedures and had no hemorrhagic complications. Gainey et al reported six patients who underwent vitreoretinal surgery and also reported no complications. Narendran and Williamson reported seven patients who underwent vitreoretinal surgery; one patient had a postoperative choroidal hemorrhage and one had a recurrent vitreous hemorrhage. Fu et al reported 10 patients who underwent surgery with an INR greater than than 2.0. One of these patients experienced a hemorrhage at the time of external drainage during a scleral buckling procedure.
To the best of our knowledge, our study is the largest set of results for vitreoretinal surgery in patients for whom warfarin anticoagulation was maintained. Although our study includes a relatively large number of patients for the ophthalmic literature, it suffers because of its retrospective nature and small size. Nevertheless, our data indicate that both local and general anesthesia can be safely used in these patients without an increased risk of intraoperative hemorrhage. Furthermore, our data indicate that postoperative hemorrhage was encountered infrequently in these patients. Overall, 5% of patients with an INR less than 2.0 had postoperative hemorrhage, and 11% with an INR of 2.0 or greater had postoperative hemorrhage. None of these patients had hemorrhagic complications that resulted in sustained visual loss or required further surgical intervention.

An interesting finding in our series relates to the frequency of subtherapeutic levels of anticoagulation in patients who are on maintenance therapy with warfarin. We found that many patients taking warfarin actually have subtherapeutic levels of anticoagulation as measured by their INR. It is interesting that postoperative hemorrhages occurred in patients with subtherapeutic as well as therapeutic levels of anticoagulation. Therefore, some postoperative hemorrhages may not be related to warfarin use.

Our anesthetic and surgical techniques were modified accordingly. Those who underwent general anesthesia were managed by conventional anesthetic techniques. However, for procedures done under local anesthesia, the technique we employed was sedation followed by application of topical anesthetic. This was followed by infiltration by creating a subconjunctival bleb using a sharp 30-gauge needle. The conjunctiva and Tenon capsule were then incised through the bleb, and a blunt cannula was passed into the retrobulbar space, allowing infusion of anesthetic. This resulted in satisfactory anesthesia and akinesia to complete the procedure and was not associated with peribulbar or retrobulbar hemorrhage. Our principal modifications of the surgical technique involved meticulous dissection of episcleral vessels when performing sclerectomies or during exposure for scleral buckling. Intraoperative dissection of fibrovascular proliferation was also done in a meticulous and repetitive fashion to be certain that all detectable vessels were closed. Finally, based on the experience of Fu and colleagues, we avoided external drainage of subretinal fluid at the time of buckling, but instead managed retinal detachment with internal drainage followed by endolaser and gas tamponade.

CONCLUSION

The decision to modify, discontinue, or continue anticoagulation must be taken on a case-by-case basis. Multiple factors must be considered, such as the patient’s underlying systemic disease and the specific surgical procedure required for management of the underlying vitreoretinal abnormality. When considering surgical intervention, it may also be appropriate to consult the physicians who are responsible for initiating and maintaining the patient’s anticoagulation status. Our experience has shown that, for many patients, vitreoretinal surgery can be safely performed while maintaining anticoagulation, thus avoiding the potential morbidity or mortality that has been associated with cessation of anticoagulation.

In reviewing the literature and our data, it is reasonable to conclude that, for patients in whom the systemic risk of cessation of anticoagulation may be substantial, vitreoretinal surgery while maintaining anticoagulation may be considered. To minimize the risk of intraoperative or postoperative bleeding, modifications of anesthetic and surgical technique should be considered. Despite these modifications, it is clear that some patients may have vitreous hemorrhage evident postoperatively. Whether such hemorrhage represents postoperative bleeding or simply residual hemorrhage is uncertain. However, it is reassuring to know that excellent visual results can be achieved in patients without repeated surgical intervention. Most important, patients must be carefully informed of the risks of intraoperative or postoperative hemorrhage and closely followed in the postoperative period.

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