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Implications of Office-Based Pterygium Surgery for Neurological Practice

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Abstract

The transition of surgical procedures from hospital-based to office-based settings has raised important considerations regarding patient safety, cost-effectiveness, and procedural outcomes. The recent study by Cremers *et al.* (2025) evaluates the safety and efficacy of office-based pterygium surgery, reporting low complication rates, minimal postoperative pain, and significant cost savings. Of particular neurological interest is the reported case of central retinal artery occlusion following a peribulbar injection containing epinephrine, highlighting the potential vascular risks associated with local anesthetic administration. This commentary explores the broader implications of these findings for neurological practice, emphasizing the importance of vascular risk mitigation, interdisciplinary collaboration, and the expanding role of office-based procedures in modern medicine. Understanding the safety protocols employed in ophthalmology can inform best practices in neurology, particularly regarding outpatient procedural safety and the management of patients with complex comorbidities.

Keywords: Cerebrovascular regulation, Clinical Neruology, Neuro-immunology

Introduction

The increasing shift of surgical procedures from hospital-based to office-based settings is reshaping modern healthcare by emphasizing cost-effectiveness, patient convenience, and procedural safety. The study by Cremers *et al.* (2025) provides compelling evidence that office-based pterygium surgery can be performed with low complication rates, high patient satisfaction, and significant cost savings. This transition aligns with broader trends in medical practice, where minimally invasive procedures in outpatient settings are becoming more prevalent [1]. However, the neurological implications of such a shift warrant discussion, particularly in relation to vascular risks, anesthetic considerations, and interdisciplinary patient care.

Interdisciplinary Collaboration in Skull Base Surgery

Skull base surgery exemplifies the intersection of neurosurgery, neurology, and ear, nose, and throat (ENT) specialties. Lesions in the skull base (such as pituitary tumors, chordomas, and other neoplasms) often reside near critical neurovascular structures, requiring a team approach for safe removal [2]. Modern minimally invasive techniques, particularly the endoscopic endonasal approach, have revolutionized skull base surgery by allowing surgeons to access deep-seated lesions through the nasal passages without external craniotomy. This approach typically involves ENT surgeons and neurosurgeons working in tandem, sometimes simultaneously, during all phases of the operation . Such collaboration leverages the ENT surgeon's expertise in endonasal pathways and the neurosurgeon's skill in tumor resection, achieving outcomes with lower morbidity and no visible scarring. Neurologists also play a role in the interdisciplinary team: they are often involved in the preoperative evaluation of cranial nerve function, hormonal assessment for pituitary lesions, and postoperative neurological monitoring or rehabilitation [2]. As office-based and ambulatory surgical suites become more advanced, certain smaller skull base procedures (e.g., endoscopic nasal repair of cerebrospinal fluid leaks or biopsy of accessible tumors) might be performed in these settings, provided that the same teamwork and safety protocols are in place as in a hospital. The close collaboration among ENT, neurology, and neurosurgery ensures that even in an office-

based environment, the complex anatomy and physiology of the skull base are respected and managed by the appropriate specialists for the best patient outcomes [2].

Vascular Risk and the Importance of Anesthetic Choice

A noteworthy finding in the study was a single case of central retinal artery occlusion (CRAO) following a peribulbar injection containing epinephrine. While rare, CRAO is an ophthalmic emergency that shares many pathophysiologic similarities with ischemic stroke [3]. The event highlights the delicate balance between optimizing surgical conditions and avoiding vascular compromise, particularly when using vasoconstrictive agents. Hayreh (2011) notes that occlusion of the central retinal artery results in sudden, painless monocular vision loss, often with irreversible consequences if not treated immediately [4]. This is analogous to cerebral infarction, where timely intervention is critical to salvage neuronal function. The decision by Cremers *et al.* (2025) to remove epinephrine from subsequent anesthetic regimens underscores the need for heightened awareness of vascular risks, especially in patients with predisposing conditions such as hypertension, diabetes, or carotid artery disease [3].

Office-Based Procedures and Patient-Centered Care

The findings from Cremers *et al.* (2025) align with the broader movement toward outpatient surgical interventions, which aim to reduce healthcare costs while maintaining high standards of care [3]. The study reported low patient-reported pain scores (below 1.0 on an 11-point scale) and a high rate of cosmetic satisfaction (above 88% at one year), suggesting that office-based procedures can achieve outcomes comparable to those performed in hospital settings. From a neurological perspective, this transition holds promise for outpatient neurology procedures, including certain nerve blocks, electromyography-guided injections, and minimally invasive treatments for headache disorders. Office-based interventions may also minimize the risk of hospital-acquired infections and reduce the burden on inpatient resources, allowing for more efficient patient management [3].

Interdisciplinary Implications for Neurology

While neurologists are not typically involved in ocular surface procedures, understanding the vascular risks associated with ophthalmic interventions is relevant, particularly for patients with overlapping cerebrovascular risk factors. The reported CRAO case in this study serves as a reminder that local anesthetic administration carries potential risks beyond the immediate surgical site. Hayreh (2011) emphasizes that embolic and thrombotic events in the ophthalmic artery can be linked to systemic vascular disease, reinforcing the importance of interdisciplinary collaboration between ophthalmologists, neurologists, and vascular specialists [4].

Moreover, as the healthcare landscape continues to evolve, neurologists may benefit from adopting similar office-based procedural models where appropriate. For instance, outpatient administration of botulinum toxin for migraine, lumbar punctures for cerebrospinal fluid analysis, and transcranial magnetic stimulation for depression could be optimized within an office setting, provided that rigorous safety measures are in place [1]. Economic Considerations and Healthcare System Efficiency

One of the most striking findings from Cremers *et al.* (2025) is the significant cost differential between office-based and hospital-based pterygium surgery. The study reports an average cost of $1,795 per office-based procedure, compared to $3,812.50 in ambulatory surgical centers and $5,562 in hospitals. This nearly threefold cost reduction underscores the economic feasibility of shifting appropriate procedures out of hospitals [3]. For neurologists, this cost-conscious approach may be particularly relevant when considering resource-intensive interventions such as inpatient electroencephalography (EEG) monitoring or hospital-based nerve conduction studies. By shifting select procedures to the outpatient setting, healthcare systems can reduce financial burdens on both patients and institutions while maintaining high-quality care.

Patient Selection and Safety in Office-Based Procedures

Strict patient selection criteria are essential when transitioning surgical procedures to an office-based setting. Guidelines from surgical and anesthesiology organizations emphasize that only lower-risk patients should undergo procedures in offices or freestanding ambulatory centers. According to the American College of Surgeons, physicians should use the American Society of Anesthesiologists (ASA) Physical Status classification to select patients, and those classified as ASA III or higher (significant systemic disease) generally should be treated in accredited surgical centers or hospitals [5]. In practice, this means that healthy or mildly to moderately ill patients (ASA I or II) are ideal candidates for office-based surgery, while patients with severe comorbidities (unstable cardiac conditions, advanced pulmonary disease, etc.) are referred to higher-acuity facilities for their safety [5]. A thorough pre-procedure evaluation, including history, focused exam, and consultations (for example, a neurologist's evaluation for patients with neurological disorders), should be documented for office-based cases. Beyond patient health status, procedure selection is also critical. The planned surgery should be of limited duration and complexity such that the patient can comfortably recover and be discharged home the same day [6]. Office-based surgeries are generally low to moderate in invasiveness with minimal expected blood loss and do not typically involve major fluid shifts or prolonged postoperative monitoring. For example, minor neurosurgical interventions (like carpal tunnel release, peripheral nerve decompressions, or certain pain management injections) and ENT procedures (such as endoscopic sinus surgery or

minor skull base repairs) can be suitable for office settings when performed by experienced surgeons. In contrast, highly complex neurosurgical operations or those requiring intensive postoperative care remain in hospitals. Surgeons must also operate strictly within their scope of practice and training, as emphasized by safety statements, and offices should be properly equipped for the planned procedure [6].

Anesthesia and monitoring in the office require special precautions. Many office-based neurological procedures utilize local anesthesia or moderate sedation instead of general anesthesia to minimize risks. If deeper sedation or general anesthesia is needed, standards demand that it be administered by qualified providers in an accredited facility [5]. Resuscitation equipment, including oxygen supply, suction, airway management tools, and emergency drugs, must be immediately available on-site. Protocols must be in place for rapid transfer to a hospital if an emergency arises [5]. Adherence to standard monitoring (pulse oximetry, capnography for sedated patients, blood pressure, EKG as needed) is as stringent in the office as in the hospital. By carefully selecting appropriate patients and procedures and by equipping office-based surgical suites with trained staff and emergency plans, surgeons can uphold patient safety equivalent to traditional hospital operating rooms.

Neurological Risks and Complications in Office Settings

Although office-based surgeries are generally safe, clinicians must be vigilant about both common and rare neurological complications. One such serious complication is CRAO, which illustrates how an office procedure can have neuro-ophthalmological implications. CRAO is essentially a stroke of the eye – an acute ischemic event in the retinal artery – and can occur in the perioperative period due to factors like intraoperative positioning, embolic phenomena, or injections near the orbital region. It is a rare complication (more often reported in prolonged spine surgeries in prone position or certain cosmetic injections), but it is devastating when it occurs, leading to sudden blindness [7]. Management of CRAO requires immediate action and interdisciplinary coordination. The condition is a medical emergency, and current best practices call for rapid recognition and triage to an emergency center, similar to management of an acute cerebral stroke [8]. Traditional acute interventions include ocular massage, anterior chamber paracentesis, and intraocular pressure-lowering medications, although these have limited evidence for efficacy. Recent literature and a scientific statement from the American Heart Association suggest that thrombolytic therapy (for example, intravenous tissue plasminogen activator) may improve outcomes if initiated early, given CRAO's parallels with ischemic stroke [8]. Regardless of specific treatment, any patient who suffers a CRAO during or after a procedure should undergo urgent evaluation for vascular risk factors and conditions like carotid artery stenosis or cardiac sources of emboli [8]. Neurologists are often consulted alongside ophthalmologists in these cases, underscoring the neurological dimension of managing an ostensibly "ocular" complication. Prevention of CRAO in office-based surgery hinges on meticulous technique – avoiding external pressure on the eyes during positioning, cautious use of injections around the face – and being prepared to recognize visual complaints in the recovery period.

Infection risk is another critical concern when shifting surgeries outside the hospital. Surprisingly, studies have shown that with proper sterile technique, office-based surgical suites do not have higher infection rates than traditional operating rooms. In a comparative study of hand surgeries performed in a hospital OR versus an office procedure room, the overall surgical site infection rates were statistically equivalent (approximately 1.86% combined) [9]. Notably, for certain procedures like carpal tunnel release, the office setting had a lower infection incidence (0.56% vs 6.7% in the hospital) [9]. These findings held true despite the office patients on average being older and having more comorbidities in that series [9]. The likely reasons include strict adherence to infection control protocols even in the office – use of field sterility, sterile instruments, proper skin antisepsis, and appropriate perioperative antibiotics when indicated – combined with the fact that office procedures tend to be shorter (reducing exposure time for pathogens). Current best practices to minimize infection risk in office-based neurosurgical and ENT procedures involve following Centers for Disease Control (CDC) guidelines for surgical sterility, maintaining clean, dedicated procedure rooms, and scheduling only cases that can be performed without compromising sterile technique. If an implant or foreign material is involved (for instance, inserting a neurostimulator or plates and screws in a bony fusion), some experts recommend performing such cases in a traditional OR environment, as deep infections in the presence of hardware are especially dangerous [9]. Overall, the evidence to date is reassuring that infection can be kept at bay in office-based surgery provided rigorous protocols are in place, and this contributes to the safety profile of moving certain surgeries out of the hospital setting [9]. Neurological monitoring and outcomes during anesthesia or sedation also require attention. Many office-based procedures avoid general anesthesia, and this can actually reduce the risk of certain neurological complications. For example, postoperative cognitive dysfunction (a decline in memory or cognition after surgery) is more common in older patients after general anesthesia. Approximately 12% of older adults who undergo a general anesthetic experience cognitive decline in the postoperative period, and 40% of those affected still have not returned to baseline by six months after surgery [9]. By using local anesthesia or conscious sedation in an office setting, practitioners may lower the incidence of such neurocognitive side effects, thus protecting brain function in vulnerable populations. Likewise, avoiding intubation and general anesthesia can reduce the risk of intraoperative strokes or hemodynamic fluctuations that might lead

to neurological deficits. That said, even under sedation, continuous monitoring is essential; hypoxia or hypotension from over-sedation can cause brain injury if not promptly corrected. Therefore, office-based anesthesiology teams must be as vigilant as hospital teams in monitoring neurological status (e.g., level of consciousness, pupillary responses) during and after procedures.

Other potential complications to consider include peripheral nerve injuries (from patient positioning or tourniquet use in limb surgeries), spinal headaches (if spinal/epidural anesthesia is utilized and a dural puncture occurs), or seizures (from local anesthetic toxicity or, in the context of transcranial procedures, from cortical stimulation). Proper patient padding, adherence to dose limits for local anesthetics, and preparedness with emergency medications (such as anticonvulsants) are prudent measures. Importantly, any complication that does occur in an office setting should trigger protocols for stabilization and immediate transfer to a higher-level care facility if needed. In summary, while office-based surgery is safe for carefully chosen cases, the surgical team must have a high index of suspicion and preparedness for neurological complications – just as they would in a hospital – to ensure patient safety.

Long-Term Outcomes and Follow-Up

When transitioning to office-based interventions, one must ask whether long-term outcomes or complication rates are compromised compared to traditional surgery. Current data suggest that for properly selected patients and procedures, long-term outcomes remain on par with those performed in hospitals. In the realm of plastic surgery, for instance, a large outcomes study of 183,914 aesthetic procedures found that accredited office-based surgical suites were a safe alternative to ambulatory surgery centers and hospitals, with no increase in adverse outcomes [10]. Patients experienced similarly low rates of complications, and the authors stressed the importance of careful patient triage to maintain these results [10]. Although this study focused on cosmetic surgery, its conclusion is relevant across specialties: an office-based setting can yield equal long-term success if it adheres to high standards of care. For neurosurgical and neurological procedures, long-term outcomes such as relief of symptoms, functional recovery, and recurrence rates have likewise been shown to depend more on the nature of the disease and the quality of surgery than on the location where the surgery is performed. A patient who has a carpal tunnel release or an endoscopic pituitary tumor resection in an office or ambulatory center can expect the same improvement in symptoms and low recurrence provided the procedure is done with the same expertise and equipment as in a hospital. What is critical is that office-based programs implement robust follow-up protocols. After an office-based surgery, patients should receive clear instructions for postoperative care and warning signs of complications (such as neurological changes, signs of infection, or persistent headaches). They should have access to prompt evaluation in case of any late complications that develop after discharge. Many surgeons schedule a follow-up call or visit within 24–48 hours for office-surgery patients to check on pain control, neurological status, and any issues, given that there is no overnight hospital observation. This ensures early detection of problems that could affect long-term outcomes. In terms of specific long-term complications, these would mirror those in hospital-based surgery – for example, scar tissue formation, chronic pain, or in the case of skull base surgery, potential delayed cranial nerve palsies or hormonal imbalances – and their incidence is tied to the procedure type rather than the venue. There is no evidence of unique long-term complications emerging solely from the office environment, except those related to possibly less aggressive intervention strategies chosen for office (for instance, using a less invasive approach to allow office treatment could in theory leave residual disease that might require re-treatment). Therefore, patient selection again plays a role in long-term success: only cases that can be definitively treated in an office setting should be brought there. When these principles are followed, long-term patient outcomes – including functional recovery and quality of life – remain high. Ongoing research and registries tracking office-based surgery outcomes will continue to inform best practices, but the current literature supports its safety and efficacy for a growing list of procedures [10].

Transcranial Magnetic Stimulation in the Office Setting

Transcranial Magnetic Stimulation (TMS) for depression is a prime example of a neurological therapy delivered entirely in an office-based setting. TMS is a non-invasive neuromodulation technique that uses magnetic fields to stimulate specific brain regions (typically the left dorsolateral prefrontal cortex) in patients with major depressive disorder. It is usually administered in a psychiatrist's or neurologist's office, in daily sessions over several weeks, and does not require anesthesia. The move of this advanced neuropsychiatric treatment out of the hospital into offices highlights both the possibilities and the responsibilities that come with office-based care.

Procedure and neurological basis

During TMS, a coil is placed on the patient's scalp, and targeted magnetic pulses induce small electrical currents in the underlying brain tissue. This process modulates neuronal activity in circuits implicated in mood regulation. Studies have shown that TMS can produce antidepressant effects that are as durable as those achieved with medication or electroconvulsive therapy, without the systemic side effects of drugs [11]. Neurologically, TMS leverages principles of cortical plasticity – repeated stimulation sessions gradually alter synaptic strength and neurotransmitter levels, which can alleviate depressive symptoms. Because TMS does not require sedation, patients remain awake and can resume normal activities immediately after each session, making it highly suitable for the office environment.

Side effects and safety

TMS is generally well-tolerated, but it is not without side effects. The most common adverse effects are mild and localized. Research indicates that about 5–10% of patients report headaches during or after TMS sessions, and a smaller fraction (2–3%) experience discomfort at the stimulation site on the scalp [12]. These effects are usually transient and can be managed with simple analgesics or adjusting the stimulation parameters. Unlike electroconvulsive therapy, TMS does not cause significant memory loss or cognitive impairment – in fact, no notable neurocognitive adverse effects have been observed in depression trials of TMS [13].

More serious side effects are rare but warrant discussion and precautions. The most significant risk is inducing a seizure, as the magnetic stimulation can, in very uncommon instances, trigger an unintended neuronal discharge. However, with modern protocols and adherence to safety guidelines (screening out patients with epilepsy or brain lesions, and using appropriate stimulation frequencies and intensities), seizures occur in only a very small fraction of cases (estimated far less than 1%). Other uncommon risks include temporary hearing loss (due to the loud clicking sound of the TMS coil with each pulse) if ear protection is not used, and mania in patients with bipolar disorder who are inadvertently treated during a depressive phase [14]. To mitigate these risks, clinics should provide earplugs during TMS and carefully screen for any history of seizures or bipolar mania before treatment. Additionally, there have been isolated reports of TMS coinciding with other events such as retinal detachment or increased suicidal ideation [12], though causal relationships are unclear. Overall, large reviews conclude that rTMS is a well-tolerated and safe treatment; most side effects are mild and self-limited, and serious adverse events like seizures or manic switch are uncommon with proper precautions [14]. Practitioners in the office setting must be prepared to handle a seizure should it occur (with training in basic seizure first aid and medications on hand) and have protocols for urgent referral if any unexpected serious event arises.

Efficacy and follow-up

From a neurological perspective, the efficacy of TMS in depression also raises interesting long-term considerations. Many patients who respond to TMS will sustain improvement for months or longer, but some may need maintenance sessions or repeat treatment courses. Conducting this therapy in an office allows for convenient follow-up treatments and monitoring of depression symptoms over time. Psychiatrists and neurologists collaborate by evaluating mood and cognitive status at baseline and periodically during the TMS course. If a patient does not respond to TMS, referral for more intensive treatments (such as inpatient care or electroconvulsive therapy) might be necessary, representing another facet of how office-based care interfaces with higher-acuity services. Nevertheless, TMS stands as an excellent example of a complex neurological intervention successfully delivered in an outpatient setting, benefiting from the comfort of an office while maintaining rigorous safety standards.

Ethical and Economic Considerations

Transitioning procedures to the office setting comes with ethical obligations to maintain patient safety, quality of care, and informed consent standards, as well as potential economic benefits. One ethical priority is patient safety versus cost savings. Office-based surgery can be significantly less costly than hospital surgery for the same procedure [9], which benefits patients and the healthcare system by reducing facility fees. However, cost considerations should never trump safety. Physicians have a duty to ensure that any procedure moved to the office meets the same safety criteria as in a hospital. This means having appropriate facilities, trained staff, and emergency preparedness. It would be unethical to perform a procedure in an office that is not adequately equipped just to save money. All applicable regulations and guidelines should be followed even in private offices – yet, it is noteworthy that office settings in many regions have less regulatory oversight compared to hospitals [6]. This places the onus on practitioners to self-regulate and seek accreditation of their office operating rooms. Engaging in voluntary accreditation programs or adhering to professional society statements (like those of the ACS and ASA) helps create an optimal and ethical practice environment despite the lighter external regulation [5].

Informed consent is another ethical cornerstone. Patients must be informed when a procedure is to be done in an office rather than a hospital, including a discussion of the differences in setting and any implications that might have. The consent process should clearly cover the nature of the anesthesia (e.g., "awake" or sedated), the emergency plans in place, and the rationale for why the Office is an appropriate venue. Ensuring the patient understands the risks, benefits, and alternatives – including the option of hospital-based surgery – is essential for truly informed consent [5]. Patients should never feel that they are receiving a "lower" level of care; rather, they should be empowered to choose the setting with full knowledge that the standard of care will be maintained.

There are also considerations of equity and access. Office-based surgery, by lowering costs, can increase access to certain procedures for patients who might otherwise face long hospital wait times or higher bills. This is a positive development, but care must be taken to ensure that all patients who are appropriate candidates are offered this option, not just those of certain socioeconomic status or those treated in certain private practices. Conversely, surgeons must guard against any financial conflicts of interest. If a practitioner has an ownership stake in an office surgery suite, they must ensure that clinical judgment about the best setting for the

surgery is not swayed by personal financial gain. The decision to proceed in an office should be based on patient factors and safety, not profit. Transparency about such arrangements and, if needed, involving a multidisciplinary case review for borderline candidates can help manage this ethical issue.

From a cost-efficiency standpoint, the trend toward office-based surgery has been largely positive. Studies have documented reduced costs for procedures done in offices without compromising outcomes [9]. These savings come from avoiding hospital facility fees, optimizing use of local anesthesia, and improving throughput. For healthcare systems and payers, office-based surgery can free up hospital ORs for more complex cases and potentially reduce overall healthcare expenditure. Ethically, reducing unnecessary healthcare costs while maintaining quality aligns with the principle of justice (better allocation of resources). Patients often appreciate the lower co-pays or out-of-pocket costs and the convenience of an office setting. That said, practices should consider the follow-up and continuity of care costs as well – ensuring that any complications or emergency transfers do not financially or emotionally burden the patient unexpectedly.

Finally, the ethical oversight of office-based surgery may involve credentialing and continuous quality improvement. Regular audits of outcomes, peer review of any adverse events, and maintaining credentials (for example, continuing education in office-based anesthesia safety) are part of the professional responsibility of surgeons expanding into this arena. By instituting these checks and balances, the medical community can uphold patient trust that "office-based" does not mean "lesser" care. As one safety commentary analogized, surgeons performing office procedures should adhere to protocols just as airline pilots do – standardized and team-based – rather than a lax "custom" approach, to minimize errors [15]. In essence, ethical practice in office-based surgery demands the same vigilance, transparency, and patient-centered focus as in the hospital, with the added diligence to compensate for the differences in setting.

Conclusion

The migration of certain neurosurgical, neurological, and ENT procedures to office-based settings represents a significant shift in surgical care delivery. This transition is supported by advancements in minimally invasive techniques, better tolerated anesthesia methods, and a drive for cost-effectiveness. From a neurological perspective, the implications are broad: interdisciplinary teamwork (as exemplified in skull base surgery) remains crucial, patient selection is more important than ever, and vigilance for complications like CRAO or other neurological sequelae must be maintained outside the traditional hospital environment. Evidence to date indicates that, with proper protocols, office-based surgery can achieve outcomes comparable to hospital-based surgery, with similar low complication rates [9,10]. Patients benefit from reduced costs and potentially quicker recovery times, especially when avoiding general anesthesia, which can reduce the risk of cognitive decline in older adults [9]. Moving forward, surgeons and neurologists must continue to refine guidelines for office-based practice, ensuring safety standards are uniform. This includes adhering to accreditation standards, investing in training for office emergencies, and engaging in continuous outcome monitoring. Long-term follow-up studies will further illuminate the durability of outcomes for office-based interventions, but the current data are reassuring. As the case of transcranial magnetic stimulation for depression illustrates, even complex neurotherapeutic procedures can be delivered safely and effectively in an office setting, given adherence to best practices and careful patient management.

In embracing office-based surgery, the medical community demonstrates an ability to innovate in care delivery while upholding the primacy of patient well-being. The neurological implications underscore that "office-based" is not merely a change of venue – it is a collaborative, patient-centered approach that, when executed conscientiously, can expand access to high-quality surgical care without compromise. By addressing interdisciplinary needs, managing risks, considering ethical dimensions, and focusing on outcomes, healthcare providers can ensure that the expansion of office-based surgery continues to be a success for patients and practitioners alike.

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