broad spectrum antibiotics, topical corticosteroids, and in most cases, a trial of oral corticosteroids.[1936,1937,2268–2270] These benefits were reflected in substantially greater QoL improvements as well as decreased used of antibiotics, oral corticosteroids, and reduced absenteeism in the group treated surgically.[245,1936,1937,2268–2270] Finally, several modeling based economic evaluations have demonstrate that an ESS strategy has a higher probability of being the more cost-effective intervention in patients with refractory CRS compared to continuing with medical therapy alone.[235,2271]

There is an immense body of literature which attempts to identity factors which impact outcomes after ESS for CRS. Individual studies have suggested differential impact related to demographics (age,[1942,1943] gender[2272]), comorbidities (asthma,[2273] aspirin sensitivity,[2274] depression[80]), disease severity (steroid dependence[2033]), disease duration,[95,1917,1918] surgeon,[2037] prior surgery,[1816] extent of surgery,[1781] and length of follow-up, among others.[1938] Despite possible differences across groups defined by these measures, all groups generally experience statistically and clinically significant improvement. There has generally been no difference in overall QoL outcomes between CRSsNP and CRSwNP patients,[1816] although the latter likely have a higher revision surgery rate.[189]

Current research efforts are focused on rigorously defining endotypes to categorize subsets of patients with CRS. Presumably, patients with different CRS endotypes may differ in their long-term response to ESS. If and when putative endotypes are defined, it will be important to determine whether outcomes of ESS differ across groups. These future studies will be critical in developing personalized approaches.

XII.G | Complications of Sinus Surgery and Prevention Strategies

ESS is an effective treatment modality for medically recalcitrant CRS. ESS outcomes have improved over the years due to advances in technology and surgical training. Despite these improvements, complications still occur during surgery due to the close proximity of the sinuses to the skull base and orbit. The reported complication rate of ESS for CRS ranges from 0.36% to 5.8%, with minor and major complications occurring in up to 5.7% and 1.5% respectively.[98–104] Minor complications include epistaxis (unilateral blood loss > 100 mL), adhesions, infection, and lamina papyracea violation (subcutaneous periorbital emphysema, preseptal ecchymosis).[99] Major complications consist of hemorrhage (requiring arterial ligation, orbital decompression, transfusion, or greater than > 1000 mL), skull base injury, CSF leak, meningitis, and orbital injury.[98,104,2275] Up to 15% of patients will require revision surgery, with reported major complication rates of 0.46% in revision surgery.[98,105] While altered anatomy and adhesions can increase the risks of complications during revision ESS, the actual revision ESS complication rate was not shown to be significantly different than primary ESS rates.[98,106] Table XII-28 summarizes sinus surgery complications.[100,101,104,2275,2276]

Several studies have identified factors associated with higher risks of intraoperative complications. For instance, age greater than 40, frontal sinus work, Medicaid insurance, and use of image-guided navigation were factors associated with higher risk of complications.[98] Other intrinsic factors to consider include the presence of asthma, polyp burden,[100] disease burden, and overall health.[102] Anatomic variations can add to the risk of complications.[102,2277–2280] Surgeons should perform a detailed review of a patient's CT imaging and possess a thorough understanding of the regional anatomy to avoid complications. Several anatomic features should be identified before surgery, including the maxillary to ethmoid sinus ratio, the position of the anterior ethmoid artery to the skull base, the Keros classification or depth of the lateral lamella of the cribriform plate, the overall slope of the skull base, the pneumatization of the sphenoid sinus and presence of an Onodi cell, and any asymmetry of the skull base. Further attention should be directed toward any areas of bony dehiscence over the lamina papyracea, optic nerve, or cavernous carotid. Error et al. implemented a preoperative ESS radiographic checklist and demonstrated improvement in the identification of critical anatomic sinus variations.[2281] Table XII-29 further characterizes these anatomic features and the associated potential complications.[102,2276–2280]

Extrinsic factors that may lead to intraoperative complication include the surgeon experience, balloon sinus dilation, use of IGS, and use of powered machinery.[2275,2282–2286] The microdebrider is an excellent instrument which decreases surgical time and bleeding as well as promotes faster healing.[2282] While complications are rare, they can be extensive and encompass major complications such as severe ophthalmic damage[2284,2285] and CSF leaks.[2286] As mentioned previously, it is important to have a thorough understanding of the surgical anatomy and be cognizant of the location of critical structures during surgery, particularly when using powered instrumentation.

The value of IGS and its impact on complication rates during ESS is an area of much debate. The popular belief is that IGS is an important tool, which if used appropriately, can minimize complications during sinus surgery. Currently, there are no prospective, randomized studies evaluating the impact of IGS – nor is 1 ethically feasible. A few population-based database studies have shown a