Introduction
Children with pharmacoologically intractable epilepsy are often candidates for seizure surgery. When seizures are lateralized to one hemisphere and the contralateral hemisphere has preserved anatomical and physiological integrity, neurosurgeons may perform a hemispherectomy to prevent clinical seizures from occurring. Hemispherectomy is the most aggressive approach and has the highest morbidity among surgical options. Hemispherectomies can be performed either via excision or via disconnection. Excision, or anatomical hemispherectomy, is a total resection of the affected hemisphere with or without the basal ganglia. Anatomical hemispherectomies leave a large subdural cavity where chronic bleeding can occur, leading to obstruction and hydrocephalus years later. This can lead to ventriculoperitoneal shunt placement with its subsequent complications, and increased morbidity among those patients. Disconnection, or functional hemispherectomy, disconnects the two hemispheres by performing an anatomic subtotal hemispherectomy and a corpus callosotomy. Neurons can generate epileptogenic potentials, however, these potentials have nowhere to travel. Functional hemispherectomies leave much more of the hemisphere in place, typically resulting in fewer long-term complications. Intraoperative management during these cases can be challenging to anesthesiologists. The purpose of this retrospective chart review is to characterize the perioperative course and long-term outcomes of these patients.

Methods
After obtaining approval of the hospital’s institutional review board, the electronic and paper medical records were reviewed of all patients who underwent a hemispherectomy at Boston Children’s Hospital from July, 2002 through April, 2011. Baseline characteristics of gender, age at surgery, onset of surgery, time from seizures onset to surgical procedure, and comorbidities of gastroesophageal reflux disease, cardiovascular disease, respiratory disease, coagulation factor deficiencies, and the use of intraoperative TXA were recorded. Intraoperative estimated blood loss (EBL), need for intravenous blood transfusion, and need for vasopressors were recorded. Need for postoperative mechanical ventilation, days of postoperative ventilation (if left intubated postoperatively), and long-term outcomes of shunt-dependent hydrocephalus, seizures postoperatively, and time to seizure were recorded. Comparisons were made between functional and anatomical hemispherectomies using t-tests for comparisons of means for continuous data, Fisher’s exact test for categorical data, and Kaplan Meier time-to-event analysis.

Results
This retrospective review of 32 patients compared the anatomical to functional hemispherectomy. On univariate analysis, we found statistically significant differences in intraoperative blood loss, need of blood products, need for postoperative mechanical ventilation, and shunt-dependent hydrocephalus. There were no differences in need for vasopressors, days of postoperative ventilation (if kept intubated afterwards), and continued seizures afterwards. On multivariate analysis, when adjusting for the difference in age between the two groups, only a statistically significant difference was found in intravenous blood loss. On time to seizure occurrence after surgery, there was no statistically significant difference between anatomical and functional hemispherectomy.

Discussion:
This retrospective review of 32 patients compared anatomical to functional hemispherectomy. Each approach has advantages and disadvantages. Anatomical hemispherectomy was first attempted in 1928 by Dandy and subsequently employed by Rasmussen and others. However, it became clear that a portion of these patients developed significant long-term problems including brainstem dysfunction, hydrocephalus (30-70% of patients), and recurrence of seizures, which collectively lead to death. Because of these complications, Rasmussen described a variation known as the functional hemispherectomy. This consisted of limited resections and disconnection of cortical tissue, resection of the amygdala, resection disconnection of the hippocampus, and a corpus callosotomy. There are some limitations to this study. This was a retrospective chart review and data collection was challenging. Some data points were based on clinician estimation (e.g. estimated blood loss). The investigation was designed as a descriptive study of a series of patients and thus, the results are limited. This is the largest series of patients undergoing hemispherectomy in the anesthesia literature and is the first to compare anatomical and functional hemispherectomy. Further, this is a large number of patients for a very rare procedure. This report is quite relevant to anesthesiologists as it should help inform what to expect during such procedures. Flack et al presented a series of 7 patients all under three years of age undergoing functional hemispherectomies. They reported that blood loss and its sequelae were the most common complications. Our study included 32 patients and compared the two types of hemispherectomy surgery for intractable seizures. Our study determined that while blood loss was still quite large in the functional hemispherectomy, it was statistically significant decrease when compared to the anatomical approach. Some of the sequelae associated with blood loss (need for a blood transfusion, use of intraoperative vasopressors, and need for postoperative mechanical ventilation) seemed to improve with the functional hemispherectomy as well. However, when adjusting for imbalances in the baseline characteristics of the two surgical types, the different rates of these sequelae were not statistically significant. Other considerations such as existing comorbidities, anticonvulsant therapy and its effects, and evolving coagulopathies must also be of concern to the anesthesiologist. In conclusion, both procedures demonstrated efficacy in controlling seizures, but functional hemispherectomy was associated with less estimated blood loss intraoperatively than the anatomical approach.

References