Abstract
Fusiform dilation of the internal carotid artery following surgery is an infrequent vascular complication after resection of suprasellar lesions in the pediatric population. We here reported 2 symptomatic cases that were treated by internal maxillary artery bypass more than 5 years after total removal of a craniopharyngioma at an outside institution. Both cases of fusiform dilation of the internal carotid artery were resected to release the mass effect and to expose the craniopharyngioma. The postoperative course was uneventful, and radiologic imaging revealed graft conduit patency. This finding suggests that bypass surgery is an useful therapeutic approach for symptomatic cases of fusiform dilation of the internal carotid artery and total removal of recurrent craniopharyngioma. Moreover, the indications for surgical intervention and treatment modalities are discussed in the context of previous relevant cases.

Introduction
Craniopharyngioma is one of the most common intracranial tumors in the pediatric population, and it arises from cells of Rathke’s pouch remnants. Radical excision makes the tumor rarely recurrent and provides satisfactory outcomes. The rate of gross total removal of craniopharyngiomas has reached 90%, and the mortality rate has declined to less than 4% as practitioners become increasingly experienced.1,15 Although postoperative complications such as hypothalamic dysfunction, diabetes insipidus, vision deterioration and blood sodium disturbance are not rare following craniopharyngioma resection, only a small number of case series have been reported about fusiform dilation of the internal carotid artery (FDICA).1,6,8,10,14,15,16 In this report, authors presented two cases of FDICA with apparent clinical symptoms, and internal maxillary artery bypass was attempted, followed by both dilation and recurrent tumor resection. Those two patients had undergone gross total removal of the craniopharyngioma more than 5 years ago at an outside institution. Although several reports of surgical intervention to treat FDICA exist in the literature,4,5,7,10,14,15,16 this is the first report regarding extracranial-to-intracranial bypass to treat this complication. Our two cases bring the number of treated FDICAs to nine. We have also reviewed the literature on related cases, emphasizing the indications and the choice of treatment options for FDICA.

Case 1
A 15-year-old boy presented to our hospital with a 2-year history of right-sided visual deficits. He had undergone total gross resection of a craniopharyngioma via right peririnal approach in the mid 2010. Tumor recurrence was detected at the 3-year follow-up without vascular abnormality. Several months prior to being referred to our hospital, a dilation of the right supracranial segment of the internal carotid artery with suprasellar lesion consistent with recurrent craniopharyngioma. This diagnosis was confirmed by cerebral angiogram. An internal maxillary artery bypass was performed via end-to-end fashion anastomosis (IMA to proximal radial artery), followed by end-to-side fashion (distal arterial to M2 segment) anastomosis. Then, the FDICA was clipped after aneurysmorrhaphy to expose the tumor which was totally removed later. His post-op course was uneventful with parent graft conduit.

Case 2
A 13-year-old girl was referred to our hospital with a 3-month history of severe headache and vomiting. She underwent gross total resection of a craniopharyngioma at a different institution 5-year ago via right frontotemporal craniotomy. Preoperative imaging showed a FDICA extending from the posterior communicating artery to the bifurcation of the internal carotid. A surgical regimen was established to treat the FDICA by cerebral vascularization with or without resection of the FDICA. After opening of the supraorbital and interpeduncular cistern, a small residual tumor was detected tightly adhering to the surrounding. An IMA to proximal radial artery and then a distal radial artery to M2 segment anastomosis were performed at the first step. The dilation of the supracranial internal carotid artery was then excised after tapping. After suturing the distal end of the internal carotid artery, the craniopharyngioma was radically resected from the adjacent vessels. Her post-op course was uneventful with parent graft conduit.

Discussion
FDICA is a rare vascular complication of surgery for craniopharyngioma (CP). Since the first report by Sutton,3 thirty-seven cases of FDICA after CP removal have been reported in the literature, excluding our 2 bypass cases. The incidence rate ranges from 2.4% to 29%,8,14,15and all the cases have occurred in the pediatric population. This phenomenon tends to occur ipsilateral to the surgical exposure due to the intraoperative manipulation of the internal carotid artery as a result of the self-healing process following injury to the carotid artery.8 The conservative or aggressive management of FDICA after CP resection remains a controversial issue. The majority of cases experience a stable clinical course, and the conservative modality with radiographic observation is recommended in these cases.1,3,8,14,15 However, surgical exploration should be reserved for symptomatic patients, such as those with persistent or severe headache attributed to the lesion, neurological deficits from mass effect, thromboembolic events or focal changes in morphological characteristics.2,9

Conclusions
FDICA is a rare complication after surgical resection of craniopharyngioma. Bypass surgery for FDICA should be considered in a small subset of patients, especially those whose clinical symptoms have continuously developed or when secondary resection of recurrent craniopharyngioma is needed.