

## Systematic Review

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# A Review of the Role of the Endoscopic Sinus Surgery in the Management of Sinusitis Complicated by Extradural Vs. Subdural Brain Abscesses

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### ABSTRACT

**Objective:** To review the literature comparing management of extradural and subdural complications of acute sinusitis and the role of the rhinologist in managing these complications.

**Patient Population:** Adult and pediatric patients presenting with acute sinusitis complicated by brain abscesses.

**Intervention:** Role of Endoscopic Sinus Surgery (ESS) in managing patients with sinusitis complicated by brain abscesses.

**Methods:** Papers from 1960-2015 discussing subdural and extradural complications of acute sinusitis and the role of sinus surgery.

**Conclusions:** The results suggest an aggressive approach to sinusitis complicated by subdural collections with a select role for conservative management in treatment of extradural collections.

**KEYWORDS:** Patients; Sinusitis; Rhinosinusitis; Sinus surgery.

**ABBREVIATIONS:** ESS: Endoscopic Sinus Surgery; EMBASE: Excerpta Medica dataBASE; MEDLINE: Medical Literature Analysis and Retrieval System Online; ARS: American Rhinologic Society.

### INTRODUCTION

Rhinosinusitis ranks among one of the most common ailments in the United States, with the prevalence of chronic sinusitis estimated at 1 in 8 individuals.<sup>1</sup> While serious intracranial complications of sinusitis are uncommon due to their decreased incidence in the antibiotic era, approximately 0.5 to 24 percent of hospitalized individuals with rhinosinusitis will progress to develop intracranial complications.<sup>2</sup> About 3 to 17 percent of patients hospitalized with acute sinusitis will develop intracranial complications.<sup>3</sup> Neurological consequences such as epidural abscess, subdural abscess, intracerebral abscess, meningitis, and venous sinus thrombosis, can be life-threatening if left untreated.

While prior studies have illustrated the necessity of neurosurgical drainage of subdural abscesses, the role of Endoscopic Sinus Surgery (ESS) in conjunction with the neurosurgical procedure has not been clearly defined.<sup>3</sup> Furthermore, it is unclear whether there is any difference in management for a subdural or extradural abscess with respect to sinus drainage. We aim to review the role of ESS in sinusitis complicated by intracranial complications looking at disease free outcomes and patient complications. The results of this study will delineate the role of ESS for sinusitis complicated by extradural and subdural collections and will provide insights for the role of sinus drainage in conjunction with medical management and neurosurgical intervention.

**MATERIALS AND METHODS**

We reviewed the literature from 1960-2015 by performing Pubmed, Excerpta Medica dataBASE (EMBASE), Medical Literature Analysis and Retrieval System Online (MEDLINE), and Cochrane searches using the search terms “intracranial”, “sinusitis”, “complications”, “abscess”, “extradural”, “epidural”, “subdural”, and various combinations of the terms.

Randomized Control Trials (RCTs), experimental studies without randomization, and observational studies with and without control groups examining the role of ESS in neurologic complications of acute sinusitis, in both adults and pediatric patients, were included in the study. Patients with no other source of intracranial infection besides the sinuses were also included. Case reports, non-full text articles, and studies

written in a language other than English were excluded.

**RESULTS**

A total of 18 papers were identified that met our inclusion criteria, which included 320 patients. Table 1 summarizes the demographic data in these studies. Of these patients, there were 94 extradural abscesses and 156 subdural abscesses (Table 2). Generally, all patients regardless of whether they had an extradural or subdural abscess underwent surgical intervention. Gallagher et al performed a case series of 15 patients with suppurative intracranial complications of sinusitis in which all patients underwent sinus procedures. They argue that sinus drainage is necessary in conjunction with a neurosurgical procedure for adequate treatment regardless of the type of abscess, given that the sinuses are the original source of infection.<sup>17</sup> Many of the papers did not stratify the type of surgical proce-

Study Authors	Year of Publication	Country	Study Design	Data Collection	Sample Size	Study Groups	Interventions
Leong et al <sup>9</sup>	2011	USA	Case series	Chart review	14	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Hicks et al <sup>2</sup>	2011	USA	Case series	Chart review	13	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Kwang et al <sup>10</sup>	2002	Singapore	Case series	Chart review	7	Pediatric patients undergoing drainage of sinuses and intracranial collections	Medical treatment, ESS, craniotomy
Sommer et al <sup>11</sup>	2011	Canada	Case reports	Case reports	4	Adults undergoing trans-nasal endoscopic drainage of sinuses and intracranial abscess	Medical treatment, ESS, craniotomy
Del Gaudio et al <sup>4</sup>	2010	USA	Case series	Chart review	23	Adults with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Kombogiorgas et al <sup>12</sup>	2007	UK	Case series	Chart review	11	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Germiller et al <sup>13</sup>	2006	USA	Case series	Chart review	25	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Glickstein et al <sup>14</sup>	2006	USA	Case series	Chart review	21	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Heran et al <sup>8</sup>	2003	USA	Case series	Chart review	8	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Younis et al <sup>1</sup>	2002	USA	Case series	Chart review	39	Adult patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Albu et al <sup>15</sup>	2001	Romania	Case series	Chart review	16	Adult patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Fenton et al <sup>16</sup>	1999	Ireland	Case series	Chart review	16	Adult patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Gallagher et al <sup>17</sup>	1998	USA	Case series	Chart review	15	Adult patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Giannoni et al <sup>18</sup>	1998	USA	Case series	Chart review	10	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Altman et al <sup>19</sup>	1997	USA	Case series	Chart review	7	Adolescent patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Giannoni et al <sup>20</sup>	1997	USA	Case series	Chart review	203	Adult patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Clayman et al <sup>7</sup>	1991	USA	Case series	Chart review	24	Adult patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy
Patel et al <sup>6</sup>	2015	UK	Case series	Chart review	27	Pediatric patients with sinusitis and intracranial complications	Medical treatment, ESS, craniotomy

Table 1: Author information.

Total Sample Size	483
Average age	17.18
Percent Male	75
Percent Female	25
Number of Subdural Abscesses	156
Number of Extradural Abscesses	94

Table 2: Demographic data.

ture based on whether the patient had a subdural or extradural abscess. Of the studies that stratified the type of surgical procedure, Del Gaudio et al published a paper in which all 8 patients with extradural abscesses underwent ESS yet they still required subsequent craniotomy.<sup>4</sup> Based on their results, they found that smaller intracranial abscess (<1 cm) without focal neurologic deficits could be managed with intravenous antibiotics and serial imaging while those greater than 1 cm necessitated early neurosurgical intervention.

A paper by Jones suggested that failure to perform ESS at early stages was associated with the need for additional craniotomies.<sup>5</sup> In this study, 77 percent of patients with intracranial collections underwent ESS, including frontal sinusotomy and ethmoidectomy.<sup>5</sup> Of the remaining patients, all underwent craniotomy with an additional 33 percent requiring future sinus drainage. Similarly, Clayman et al illustrated a direct correlation between surgical delay and increased length of hospitalization.<sup>7</sup> Albu et al found similar findings in their study and suggested that complications were associated with a delay between diagnosis and urgent surgical treatment as well as by the presence of subdural abscess.<sup>15</sup>

Studies on patients in the pediatric population had similar findings. Patel et al in their study on pediatric sinusitis suggested that early ESS was associated with a faster recovery and shorter length of stay.<sup>6</sup> The only three patients in their study who did not undergo ESS had frontal sinus cranializations that negated the need for sinus surgery. Ong et al also found similar findings in their case series on seven pediatric patients with suppurative intracranial complications of sinusitis. All patients underwent sinus surgery in conjunction with early neurosurgical drainage with the exception of one patient, who underwent frontal sinus trephination. While some patients required additional craniotomies, there were no mortalities in the study.<sup>3</sup> Another case series on intracranial complications of sinusitis in children and adolescents by Germiller et al illustrated that nearly all underwent sinus drainage with the exception of one who developed meningitis that was successfully treated medically and two others who received external frontal sinus trephination. Of these patients, there was a 4 percent mortality rate and 8 percent morbidity rate that included patients with residual, long-term neurological deficits.<sup>13</sup> Other case series such as the one by Leong et al, Glickstein et al, and Gianonni et al also supported an aggressive medical and surgical approach.<sup>9,14,18</sup>

However, conservative management may be an option

for extradural collections. A 2002 review by Heran illustrated that small epidural abscesses could be conservatively managed given adequate sinus drainage, intravenous antibiotics, and minimal extradural effect.<sup>8</sup> Of the eight patients, six underwent sinus drainage, most commonly of the frontal, ethmoid, and sphenoid sinuses. Four of these six patients also underwent a neurosurgical procedure for drainage of intracranial abscess. More equivocal was the indications for neurosurgical drainage. They suggested that neurosurgical intervention should be reserved for those patients with focal neurologic signs, evidence of intradural extension, or if adequate sinus drainage and appropriate bacteriologic cultures were unable to be achieved. Gallagher et al also cited the controversy with regards to neurosurgical management of these complications, particularly with regards to subdural empyema. Craniotomy has often been the treatment of choice but they suggest an alternative approach using aspiration with the aid of CT to localize the precise site of the collection.<sup>17</sup> Thus, ESS is suggested the first line of treatment with an option for watchful waiting for neurosurgical drainage.

**DISCUSSION**

In the vast majority of cases complicated by either extradural or subdural abscesses, ESS is necessary in conjunction with a neurosurgical procedure to address the source of infection. ESS carries a fairly low morbidity but can be more complicated in the setting of acute rhinosinusitis with active bleeding and inflammation. Medical management alone of sinusitis complicated by intracranial infection has been associated with an increased rate of complications and prolonged hospital stay. However, endoscopic drainage of the sinuses may be avoided in cases where cranialization of the frontal sinuses by neurosurgery negates the need for further rhinologic procedures.<sup>6</sup> Based on our literature review, management of subdural and extradural complications generally requires IV antibiotics, ESS and craniotomy to address the source of infection with a selective option for ESS and antibiotics alone for small (<3 cm) extradural abscesses.<sup>7</sup>

**CONCLUSIONS**

In this review article, we summarize the literature regarding management of sinusitis complicated by extradural *versus* subdural complications. While the majority of these cases require ESS as well as a neurosurgical procedure, good coordination is necessary between the otolaryngologist and the neurosurgeon as well as infectious disease specialists to provide optimal management of sinusitis with intracranial complications.<sup>9</sup>

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**CONFLICTS OF INTEREST**

The authors declare that they have no conflicts of interest.

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