

# MAGNETIC RESONANCE IMAGING IN FUNGAL SINUSITIS WITH EMPHASIS ON ADDITIONAL SEQUENCES: DIFFUSION WEIGHTED IMAGING AND SUSCEPTIBILITY WEIGHTED IMAGING

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## INTRODUCTION

All people are exposed to fungi as they are abundant in nature. The atmospheric air basically contains numerous fungal spores. Thus, pathological affection of the nose and paranasal sinuses is expected in case these spores find the suitable environment for their growth and tissue invasion.

Commonly sinonasal fungal infections are classified into invasive type and non-invasive type. The invasive type is characterized by growth of fungal hyphae invading the underlying structures; mucosa and submucosa, as well as bone and blood vessels of the infected sinuses, distinguishing it from non-invasive type.

Nowadays, early, and accurate diagnosis of fungal sinusitis is of extreme importance due to the increase in the number of COVID-19 associated invasive fungal sinusitis.

## AIM OF THE WORK

The aim of this study was to assess the role of MRI in the diagnosis of fungal sinusitis and its complications as well as emphasizing on the possible additive value of DWI and SWI in the radiological diagnosis of fungal sinusitis.

## SUBJECTS AND METHODS

This study included 31 patients (11 males, 20 females with mean age 51) suffering from fungal sinusitis who are presented to Alexandria main university hospital, 5 patients had non-invasive types (3 cases had fungal ball and 2 cases had Allergic fungal sinusitis), 26 cases of invasive fungal sinusitis (5 cases of early invasive fungal sinusitis and 21 cases of late invasive fungal sinusitis), All the patients were subjected to:

- Full history taking
- Thorough Clinical examination by ENT physicians.
- MRI study including:
  - Conventional T1W and T2W
  - Susceptibility weighted image
  - Diffusion weighted image

Postcontrast T1W fat sat image whenever it is possible to give intravenous gadolinium

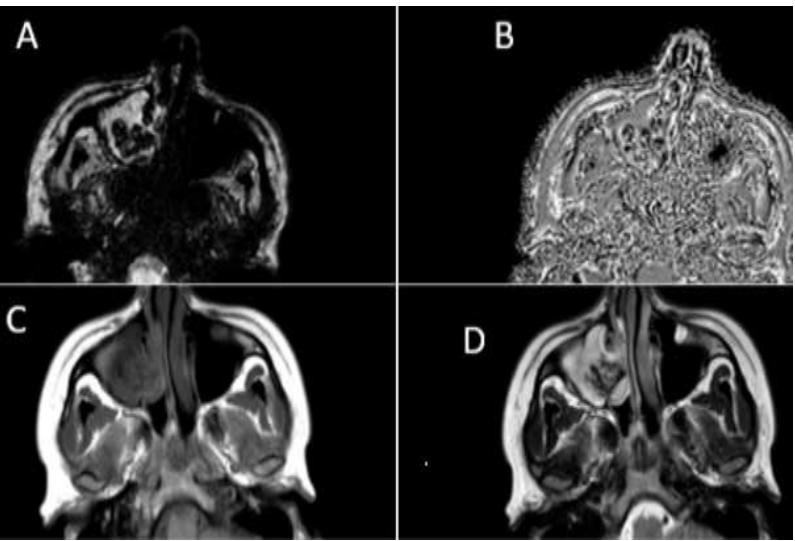
## RESULTS

**Table 1:** Comparison between the studied types of fungal sinusitis according to SWI pattern and site of blooming

| SWI pattern and site of blooming | Total<br>(n = 31) |      | Types                  |       |                    |       |                           |      |                           |      | $\chi^2$ | MCp    |
|----------------------------------|-------------------|------|------------------------|-------|--------------------|-------|---------------------------|------|---------------------------|------|----------|--------|
|                                  |                   |      | Fungal ball<br>(n = 3) |       | Allergy<br>(n = 2) |       | Early invasive<br>(n = 5) |      | Late invasive<br>(n = 21) |      |          |        |
|                                  | No.               | %    | No.                    | %     | No.                | %     | No.                       | %    | No.                       | %    |          |        |
| No definite blooming             | 7                 | 22.6 | 0                      | 0.0   | 0                  | 0.0   | 1                         | 20.0 | 6                         | 28.6 | 1.249    | 0.885  |
| Parenchymal punctate foci        | 3                 | 9.7  | 0                      | 0.0   | 0                  | 0.0   | 0                         | 0.0  | 3                         | 14.3 | 1.222    | 1.000  |
| Parenchymal rim/ring             | 3                 | 3.2  | 0                      | 0.0   | 0                  | 0.0   | 0                         | 0.0  | 3                         | 14.3 | 1.222    | 1.000  |
| Abscess core                     | 2                 | 6.5  | 0                      | 0.0   | 0                  | 0.0   | 0                         | 0.0  | 2                         | 9.5  | 1.487    | 1.000  |
| Intra-sinus blooming foci        | 15                | 45.2 | 3                      | 100.0 | 2                  | 100.0 | 4                         | 80.0 | 6                         | 28.6 | 6.746*   | 0.042* |
| Perineural linear blooming       | 1                 | 3.2  | 0                      | 0.0   | 0                  | 0.0   | 0                         | 0.0  | 1                         | 4.8  | 2.654    | 1.000  |

**Table 2:** Comparison Between the Studied Types of Invasive Fungal Sinusitis according to Restricted Pathologies on DWI

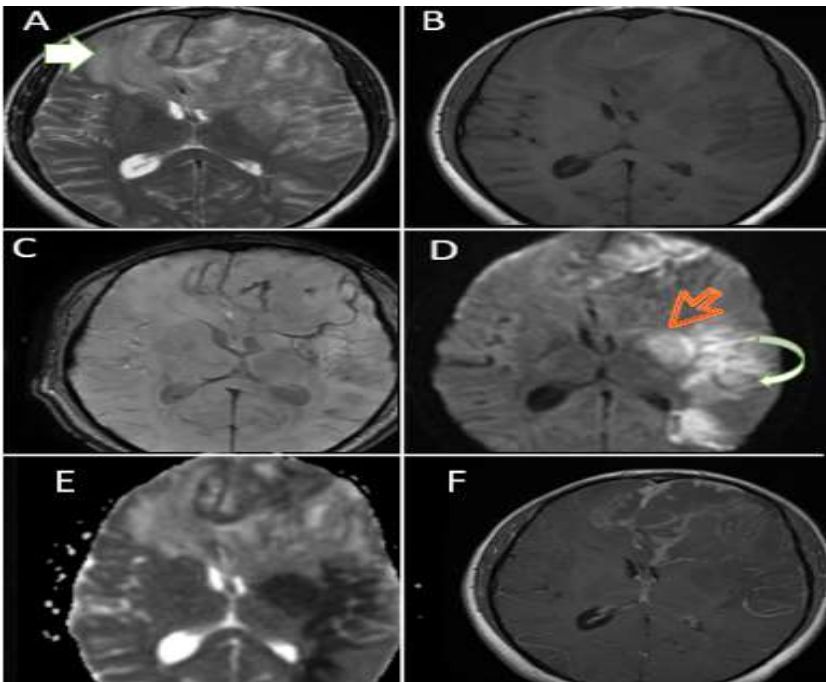
| DWI               | Total<br>(n = 26) |      | Types                     |      |                           |      | $\chi^2$ | MC <sub>p</sub> |
|-------------------|-------------------|------|---------------------------|------|---------------------------|------|----------|-----------------|
|                   |                   |      | Early invasive<br>(n = 5) |      | Late invasive<br>(n = 21) |      |          |                 |
|                   | No.               | %    | No.                       | %    | No.                       | %    |          |                 |
| Infarction        | 8                 | 30.8 | 0                         | 0.0  | 8                         | 38.1 | 2.751    | 0.281           |
| Cerebritis        | 5                 | 19.2 | 0                         | 0.0  | 5                         | 23.8 | 1.474    | 0.545           |
| Abscess           | 4                 | 15.4 | 0                         | 0.0  | 4                         | 19.0 | 1.126    | 0.555           |
| Perineural        | 7                 | 26.9 | 0                         | 0.0  | 7                         | 33.3 | 2.281    | 0.278           |
| Brain invasion    | 2                 | 7.7  | 0                         | 0.0  | 2                         | 9.5  | 0.516    | 1.000           |
| Orbital extension | 1                 | 3.8  | 0                         | 0.0  | 1                         | 4.8  | 0.248    | 1.000           |
| Cavernous sinus   | 1                 | 3.8  | 0                         | 0.0  | 1                         | 4.8  | 0.248    | 1.000           |
| Mucosal foci      | 4                 | 15.4 | 1                         | 20.0 | 3                         | 14.3 | 0.101    | 1.000           |



**Case (1):**

A) SWI & B) phase image demonstrating blooming in the right maxillary sinus denoting fungal element C) Conventional T1 axial image showing hypointense right maxillary sinus content D) Conventional T2 axial image showing intermediate intensity right maxillary sinus content with signal void foci

**Diagnosis: Right maxillary sinus fungal ball.**



**Case (2):** A)Conventional T2 axial MRI image showing extensive hyperintense bilateral frontal brain invasion (straight arrow )B) Conventional T1 MRI axial image showing extensive hypointense frontal brain invasion C) SWI showed peripheral rim of blooming either denoting paramagnetic effect (microbleeds /fungal element )D) DWI &E) ADC map denoting irregular restriction at left frontal lobe (brain invasion )and parieto-occipital lobe (cerebritis)(curved arrow) and homogenously restricted left basal ganglia infarction (arrow head) F) Postcontrast axial T1 image showing peripheral rim/ring enhancing brain invasion as well as irregular enhancing cerebritis. **Diagnosis: Advanced invasive fungal sinusitis with extensive brain invasion, cerebritis and basal ganglia infarction.**

## CONCLUSION

- MRI, specially contrast enhanced MRI study, is the modality of choice in the diagnosis of non-invasive fungal sinusitis when CT is not conclusive, as well as invasive fungal sinusitis with its intraorbital, intracranial and soft tissue extensions. As well as to add DWI and SWI to all cases of suspected fungal sinusitis as they both can help in the diagnosis of fungal sinusitis and detection of complications.