

Nursing Care of a Patient with Acute Invasive Fungal Sinusitis (AIFS) - A Case Report

P. Nancy Priyadarshini¹, S. W. Naomi Nancy²

¹BSc (N), Staff Nurse, CMC, Vellore, India

²MSc (N), Junior Lecturer, College of Nursing, CMC, Vellore, India

Abstract: *Fungi are ubiquitous, they are found in the air we inhale, food we eat and the surroundings in which we live. A functioning and a healthy immune system protect the majority of the population from developing this rare and serious disease. In a healthy adult, Fungi are unable to penetrate the epithelial layer, the first layer of defense, whereas in the presence of a weakened immune system which is most often seen in conditions such as Diabetes Mellitus, chemotherapy or Corticosteroids use, the fungi are able to penetrate normal mucosal barriers and invade host tissues. A proper diagnosis and classification of these fungal sino-nasal disorders needs a good appreciation and knowledge about the host's immune status along with other key clinical characteristics. (Soler & Schlosser, 2012)*

1. Introduction

The high prevalence of parasitic Rhinosinusitis in our country is considered to be higher because of the high predominance of type 2 Diabetes Mellitus in our nation. (Suresh et al., 2016). Nurses have an important role in educating these patients in terms of this devastating disease that is most often less thought of. As Health Care Professionals, it is a common tendency to concentrate on the five major complications of Diabetes Mellitus. But in the recent past, the prevalence of AIFS has been markedly high. Nurses need to teach these immunocompromised patients on these rising complications which can be fatal.

Classification of fungal sinusitis

Based on histopathology, clinical findings, laboratory, investigations, fungal sinusitis is classified into

Non-invasive

- Fungal ball
- Allergic fungal rhinosinusitis
- Eosinophilic fungal sinusitis

Invasive

- Acute invasive
- Chronic invasive
- Granulomatous invasive (Thiagarajan & Ramamoorthy, 2013)

2. Non-Invasive Fungal Sinusitis

Fungus Ball

A fungal ball is characterized as the thick collection of hyphae inside the mucosal limits of paranasal sinus, without tissue invasion. (Callejas & Douglas, 2013). Maxillary sinus is most commonly involved followed by sphenoid and rarely by ethmoid and frontal sinuses. (Soler & Schlosser, 2012). Fungal balls are caused mainly by *Aspergillus* species. Fungus balls more often occur in immunocompetent hosts or persons with a very subtle immunodeficiency. Radiologic imaging most regularly demonstrates total or subtotal opacification of the included sinus/sinuses. Hard thickening or sclerosis of the included sinus walls is normal. The fungi usually can be seen on routine hematoxylin and eosin stains;

however, special fungal stains can be confirmatory. A tangled mat of hyphae is present. (Ferguson, 2000)

Allergic Fungal Rhinosinusitis (AFRS)

Patients with allergy to certain fungi may develop allergic fungal sinusitis. Common fungi belonging to the dematiaceous family are usually involved in AFS. (Callejas & Douglas, 2013). The presence of fungus in the sinuses causes an allergic response, resulting in production of allergic mucin and nasal polyps. Usually, the disease affects more than one sinus on one side. (F. Goldstein, H. Dunsky, J. Dvorin, & W. Lesser, 2007)

Eosinophilic fungal Rhinosinusitis

It has been postulated that this condition could be caused by abnormal cell mediated immunity to fungal proteins. (Thiagarajan & Ramamoorthy, 2013) These patients respond well to surgical removal of polypoidal mucosa, and creation of wide anastomy which improves ventilation to the sinus mucosa.

Invasive Fungal Sinusitis

Acute Invasive Fungal Sinusitis

Acute invasive rhinosinusitis results from the rapid spread of fungi from the nasal cavity and sinus membrane by way of vascular invasion into the orbit, vessels, and brain parenchyma. This is the most dangerous and life-threatening form of fungal sinusitis. Usually only affects patients with leukemia, aplastic anemia, uncontrolled diabetes mellitus, and hemochromatosis. Patients undergoing anti-cancer chemotherapy or organ/ bone-marrow transplantation are especially susceptible. *Aspergillus* or members of the class Zygomycetes (*Mucor*, *Rhizopus*) are the most frequent causative agents. (Piromchai & Thanaviratnanich, 2012). The course of the disease lasts for less than four weeks but can actually progress over days.

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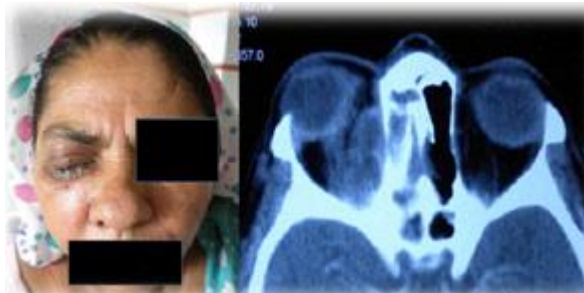


Figure 1: A patient with AIFS and the CT image showing a dense area in the left eye (Source:www.researchgate.net)

Chronic invasive fungal sinus

Chronic invasive fungal sinusitis is a slower destructive process when compared to the neutrophil-rich, highly necrotic, and angiotrophic process seen in acute invasive fungal rhinosinusitis. There is a low-grade mixed cellular infiltrate in affected tissues. It is usually seen in patients with AIDS, diabetes mellitus or chronic corticosteroid treatment. The disease most commonly affects the ethmoid and sphenoid sinuses, but may involve any sinus. The typical time course of the disease is over 3 months. (Piromchai & Thanaviratananich, 2012).

Granulomatous invasive fungal sinusitis

Granulomatous fungal sinusitis is a unique, chronic form of invasive fungal sinusitis seen in immunocompetent patients. The disease chiefly involves the maxillary and ethmoid sinuses, nose, orbit and cheek. The distinctive presence of non-caseating granuloma containing fungal hyphae differentiates this disease from chronic invasive fungal sinusitis. The disease has a relatively slow time course over 3 months. *Aspergillus flavus* is usually the causative organism.

Symptoms

- Nasal congestion
- Headache
- Post Nasal Drainage (clear or yellow/green)
- Fatigue
- Irritability
- Muscle Aching
- Diminished Sense of Smell
- Gastro Intestinal Symptoms (including indigestion and heartburn)
- Facial pressure, pain or numbness, facial swelling
- Nasal stuffiness
- Cough
- Fever
- Mental status changes
- Dark ulcers within the nasal canal or on the roof of the mouth
- Visual disturbances
- Pressure in the forehead, nose, and behind the eyes
- Decreased vision and ocular immobility (Thiagarajan & Ramamoorthy, 2013)

3. Diagnosis

Physical examination forms the basis for diagnosing any disease and AIFS is no exception. Physical exam should

include careful inspection of the nares and oral cavity for areas of necrosis. Other physical exam findings may include tenderness to palpation of the involved sinuses. Neurologic and orbital examination is also needed to rule out any nerve damage and to check for visual acuity in case of orbital involvement.

Radiographic evaluation with CT and MRI are useful in assessing the extent of disease. MRI best evaluates early changes in major vessels, including carotid artery thrombosis, cavernous sinus thrombosis, and intracranial extension. (Chakrabarti, n.d.)

Histopathological examination is used as a confirmation for diagnosing fungal rhinosinusitis. It is therefore very important to classify and manage this disease condition once fungal infection is suspected on clinical grounds. (Dr Navya BN, 2015)

Surgically obtained fungal material should be seen grossly or examined histopathologically. The fungal material should be positive for fungal hyphae on staining and cultures must grow fungi for further classification and management. Conventional haematoxylin and eosin stained sections along with special stains Grocottsmethenamine silver (GMS) stain are used. (Dr Navya BN, 2015)

4. Treatment

Non-Invasive Fungal Sinusitis

Surgery is generally considered the treatment of choice. Adequate ventilation of the sinus is essential to prevent relapse or recurrence of the disease once the disease is extirpated. A low dose of prednisone (0.5 mg/kg) in a tapering dose with alternate-day dosage over a 3-month period may be suggested if there is an extensive disease and in case of allergic fungal sinusitis. (F. Goldstein et al., 2007)

Invasive Fungal Sinusitis

Invasive fungal rhinosinusitis needs more aggressive debridement due to high recurrence, mortality and morbidity rate. Amphotericin B 1–1.5 mg/kg/day for a total dose of 2 grams or more is the gold standard antifungal therapy. (Piromchai & Thanaviratananich, 2012). Oral Itraconazole (400 mg/d) can replace amphotericin B once the acute stage has passed. Treatment of the underlying immune deficiency is desirable. (Epstein & Kern, 2008) Antifungal therapy should be for a minimum of 6 months. (Rupa, Maheswaran, Ebenezer, & Mathews, 2015)

5. Case Report

A 45 years old gentleman presented with complaints of insidious onset dull aching continuous right sided facial pain. It was associated with diffuse swelling noted over the right side of the face.

There was no associated history of headache, vomiting, seizures or focal deficits. There was no history of excessive nasal discharge or epistaxis. There was no history of redness, reduced vision, double vision or eye discharge.

He was a known diabetic for the past 5 years on OHA with poor glycaemic control. There was no past history of hypertension, asthma or allergies, tuberculosis.

On examination he had mildly tender maxilla on right side. He was initially evaluated on OPD basis. CT PNS showed bilateral maxillary sinus mucosal thickening with near complete opacification on the right side. There was also erosion of base and lateral wall of maxillary sinus with mild thinning of right orbital plate. MRI brain was done to rule out intracranial extension. He underwent a limited FESS. Subsequently the intra operative deep tissue samples grew *Rhizopusarrhizus* and Histopathology showed invasive granulomatous fungal sinusitis with broad aseptate fungal hyphae with tissue invasion and no definite angio or bony invasion.

He was readmitted and underwent Right subtotal maxillectomy and a left inferior partial maxillectomy. He was initiated on conventional amphotericin via PICC line. He had received total of 2.050 grams of amphotericin. He had persistent pain on the right side of the face. MRI face done showed residual disease in the ethmoidal/sphenoid/frontal sinuses with extension into the right extraconal space and dura. He underwent debridement of the sinuses, cultures were negative for fungal elements and biopsies were awaited. He was continued on Amphotericin and achieved a target dose of 2.050 gm. During amphotericin infusion he had developed amphotericin induced renal injury in form of hypokalemia and elevated creatinine levels which was adequately corrected with hydration and potassium correction and supplements.

He has been explained regarding the need of Posaconazole for a period six months after amphotericin and regular nasal douching and cleaning. His Insulin was titrated from short acting insulin to long acting insulin to achieve adequate glycaemic control. There were no other macro or micro vascular complications of diabetes.

Following Amphotericin patient was started on Syp. Posaconazole 400mg thrice daily for 3 days followed by Syp. Posaconazole 400mg twice daily to be continued and was advised to come for regular follow up visits.

Nursing care of the patient with Acute Invasive Fungal Sinusitis is presented using nursing process approach

1) Nursing Diagnosis

Acute pain related to an increase in sinus pressure, secondary to inflammation of the paranasal sinuses.

Expected outcome: Patient's pain is reduced as evidenced by adequate relief of pain, use of pharmacological and non-pharmacological pain relief strategies, improved well being such as baseline levels for pulse, BP, respirations and relaxed muscle tone or body posture or ability to cope with incompletely relieved pain.

Interventions:

- Assessed the patient's characteristics of pain. Pain score was 6/10. He had insidious onset dull aching right sided

facial pain. Non-opioid Analgesics were administered round the clock to control pain.

- Additional stressors or sources of discomfort were removed. Lights were put off when not needed. Visitors control was implemented to reduce further stress. Peaceful and quiet environment was offered to facilitate rest.
- Positioned him in comfortable position (fowlers) with comfort devices such as pillows and backrest in order to reduce pain and increase comfort.
- Taught diversional therapy techniques such as music, talking to a family member, reading books etc.

Evaluation: Patient's pain was effectively reduced (Score was 2/10) both in pre operative and post operative period as evidenced by patient verbalizing that pain is reduced. Patient's facial expressions were better. He understood the importance of analgesics for pain relief

2) Nursing Diagnosis

Ineffective airway clearance related to presence of copious thick nasal secretions secondary to inflammation of the sinuses and presence of nasal pack postoperatively.

Expected outcome: Patient maintains clear, open airways as evidenced by normal breath sounds, normal rate and depth of respirations, and ability to effectively cough up secretions after treatment and deep breathing exercises.

Interventions:

- Assessed for rate and depth of respiration, sputum /secretions for quality, color, amount, odor and consistency. Auscultated lungs for presence of normal or adventitious breath sounds. Had normal breath sounds and normal rate. Nasal secretions were thick and minimal.
- Assessed for patency of nasal cavity. He had complaints of mild nasal obstruction preoperatively for which normal saline nebulisations were administered.
- Optimal positioning such as sitting (fowlers) was taught to patient to facilitate comfort. Importance of ambulation and frequent position changes were also taught to promote lung expansion
- Postoperatively nasal pack was removed on the 2nd post operative day. Normal saline nasal douching was given every 2 hours. Encouraged him to do nasal douching without fail to get relieved from the nasal obstruction.

Evaluation: His respiration rate was 16/min. Had no complaints of nasal obstruction or secretions on discharge.

3) Nursing Diagnosis

Risk for noncompliance to treatment regimen related to duration of the treatment secondary to financial issues.

Expected Outcome: Patient's knowledge increases regarding the benefits and importance of complying to such treatment. Has gradual health restoration with minimal or no complications. Follows the prescribed dosage and duration. Does regular follow up visits.

Interventions:

- Assessed the patient's health perceptions and knowledge. Patient and family members were ready to comply with the new therapy recommended.

- Educated the patient and the family members on the treatment regimen that the patient will undergo and the expected side effects such as fever with chills, nausea and vomiting and the ways to cope up with them. It increased awareness among patient and family regarding the importance of completing the prescribed treatment. It provided increased compliance to such treatment.
- Developed a therapeutic relationship between the patient and significant others such as the medical and nursing team. Patient gained trust and confidence from the care giver and the medical team.
- Motivated the patient in following the treatment plan with the support of immediate family members.

Evaluation: Patient achieved a target dose of 2.050gm of Inj. Amphotericin and could not continue any further due to financial constraints which he wanted to continue at a government hospital.

4) Nursing Diagnosis

Fluid volume excess related to renal injury secondary to Inj. Amphotericin regimen.

Expected Outcome: Patient maintains adequate fluid volume as evidenced by normal creatinine and potassium levels. Normovolemic as evidenced by urine output greater than 30 ml/hr, balanced intake and output levels.

Interventions:

- Assessed the patient's intake and output and creatinine levels and serum potassium levels since Inj. Amphotericin causes hypokalemia. During the treatment regimen potassium and creatinine levels were monitored every day. The lowest potassium level during his hospital stay was 3.3mmol/L and the highest creatinine level was 1.59mg%.
- Adequate hydration was given pre and post amphotericin administration. Potassium supplements were given.
- Encouraged him take adequate fluids orally.
- Monitored intake and output closely. Maintained balanced intake and output.
- Monitored vital signs such as BP and HR. They were stable.

Evaluation: Patient demonstrated good fluid intake. Potassium and creatinine levels were 4.0mmol/l and 0.65mg% respectively on discharge.

5) Nursing Diagnosis

Anxiety related to lack of client knowledge about diseases and medical procedures, economic status, health status, stress.

Expected Outcome: At the end of the hospitalization patient describes own anxiety and coping patterns, demonstrates improved concentration and accuracy of thoughts and increased external focus. Patient has vital signs that reflect baseline or decreased sympathetic stimulation. Patient has posture, facial expressions, gestures, and activity levels that reflect decreased distress.

Interventions

- Assessed the level of anxiety of the patient. The patient appeared agitated and irritable during the course of hospitalization. He also experienced diaphoresis, urinary urgency and frequency, dry mouth and muscle tension on and off during his hospital stay.
- Acknowledged the patient's feelings and aimed at being supportive and approachable to the patient and the family. The family members were supportive and helped the patient overcome the feeling of despair during the course of hospitalization.
- Educated patient and family on the disease condition, treatment modalities and probable side effects and strategies to cope up with them and regarding signs and symptoms of anxiety.
- Advised patient to reduce his stress by listening to music or take a stroll around the ward.

Evaluation: Patient demonstrated reduced anxiety and ability to reassure self-had normal BP and respiratory rate. Patient and the family were able to cope up with the disease and treatment regimen to a considerable extent.

6) Nursing Diagnosis

Risk for complications such as mucocele, osteomyelitis and pott's puffy tumour, orbital complications, inflammatory edema, cavernous sinus thrombosis, intracranial complications, venous sinus thrombosis related to disease process.

Expected Outcome: The patient is free of complications or any residual disease and does regular follow up with the physician after the treatment.

Interventions:

Mucocele:

- Assessed the patient for symptoms like frontal headache, proptosis, diminished vision, deep nasal or periorbital pain. Did physical examination and collected past medical history to suggest presence of disease related complications.
- Encouraged completion of the treatment regimen to ensure and prevent recurrence of infections and subsequently mucocele.
- Advised regular follow up visits to hospital after discharge.

Osteomyelitis and Pott Puffy Tumour:

- Assessed the patient for symptoms like headache, photophobia, swelling of the forehead, purulent and nonpurulent rhinorrhea and fever, fluctuant and tender erythematous swelling of the scalp.
- Encouraged completion of the treatment regimen to ensure and prevent recurrence of infections.
- Advised regular follow up visits to hospital after discharge.

Orbital Cellulitis:

- Assessed the patient for orbital edema, proptosis, Chemosis.

- Sought consultation of ophthalmologists to assess for visual acuity, pupillary reaction, confrontation visual fields, color vision, extraocular motility, proptosis, globe displacement, resistance to globe retropulsion, intraocular pressure, and optic nerve appearance.
- Advised regular follow up visits to hospital after discharge

Subperiosteal Abscess:

- Assessed the patient for orbital cellulitis, worsening proptosis and gaze restriction. Assess the patient for vision, blindness. Obtain opinion of the ophthalmologist to measure intra ocular pressure.
- Advised regular follow up visits to hospital after discharge.

Orbital Abscess:

- Assessed the patient for marked proptosis, Chemosis, complete Ophthalmoplegia, and visual impairment, any purulent discharge.
- Assessed radiographic and CT findings for presence of massive proptosis, extraocular enlargement and gas formation.
- Advised regular follow up visits to hospital after discharge.

Cavernous Sinus Thrombosis:

- Assessed the patient for signs of papilledema, retinal hemorrhages and visual loss.
- Assessed radiographic and CT findings for source of any infection.
- Advised regular follow up visits to hospital after discharge.

Intracranial Complications:

- Assessed the patient for signs of intracranial invasion such as acute and rapidly progressive headache, fever, changes in mental status, photophobia, and meningismus, local pain and tenderness, lethargy, meningeal signs and seizures and vomiting, mood and behavioral changes.
- Assessed for presence of proptosis, Ophthalmoplegia, Chemosis, decreased visual acuity.
- Advised regular follow up visits to hospital after discharge.

Evaluation: Patient did not develop any complications during the course of hospitalization.

7) Nursing Diagnosis

Deficient knowledge regarding disease condition, procedure, treatment regimen related to lack of knowledge, lack of exposure, emotional state affecting learning, socioeconomic background.

Expected Outcome: Patient explains disease state, recognizes need for medications, and understands treatments, demonstrates how to incorporate new health regimen into lifestyle and shows motivation to learn.

Interventions:

- Identified the learner: the patient, family and significant others. His wife and brother were the main care takers of

the patient and they were willing to learn and perform health related care.

- Assessed the motivation and willingness of the patient to learn.
- Provided an atmosphere of respect, openness, trust, and collaboration.

Evaluation: Patient learned the treatment regimen and demonstrated nasal douching which he continued every 2 hours. He understood the need to come for regular follow up after hospitalization and was willing to continue Syrup Posaconazole at home.

6. Conclusion

Nurses have an inevitable role in caring and most importantly giving education to patients with AIFS. The key lies in treating the underlying condition. Poor glycemic control gives way to conditions like these, leading to even death of the patient. Nurses need to understand the magnitude of the disease and give adequate teaching regarding the glycemic control, regular follow up visits and home care following the surgery.

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