ANALYSIS

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Image guidance endoscopic sinus & skull base surgery in children

Zahra Almoumen[1], **Ali Almomen**[2], **Hashim W AlShakhs**[3], **Mohammed AlSaeed**[4], **Abdullah AlShakhs**[5], **Layla Abd Alaziz Almzraq**[5], **Mohammed A. Al Ameer**[5], **Salma Emad Algargoosh**[6]

[1]ENT trainee resident, King Fahad Specialist Hospital, Kingdom of Saudi Arabia
[2]Consultant Rhinology & Skull base surgery, King Fahad Specialist Hospital, Kingdom of Saudi Arabia
[3]Saudi Medicine program, King Fahad Hospital, AlAhsa, Saudi Arabia
[4]Medical intern, AlBaha University, Kingdom of Saudi Arabia
[5]Medical intern, King Faisal University, Kingdom of Saudi Arabia
[6]Medical intern, Maastricht University, Netherlands

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ABSTRACT

Background: Endoscopic sinus surgery in children has been used for treatment of chronic rhinosinusitis, complicated acute sinusitis, sinus tumor, meningoceles and congenital sinonasal malformations. The use of imaging guidance during surgery will make it safer and gives more intraoperative guidance with less complications. *Methodology*: A Retrospective study of all cases of image guided pediatric endoscopic Sinus & Skull base Surgeries performed in King Fahad Specialist Hospital-Dammam from (2009 -2019) in a

group of patients between 4-15 years of age. *Results:* 47 of pediatric cases underwent endoscopic sinus and skull base surgeries using the image guidance system. *Conclusion*: Image guidance system (IGS) is effective and safe tool that improve endoscopic approach in pediatric sinonasal and skull base surgeries with minimal morbidity and intraoperative complications. Indications of image guidance in our study includes allergic fungal sinusitis abutting orbit and skull base, different complicated sinusitis with periorbital and brain abscesses, CSF leaks and meningocele and different benign and malignant tumors affecting the orbit, infratemporal fossa and skull base.

Key words: image guidance, pediatric, endoscopic sinus surgery, skull base.

1. INTRODUCTION

Endoscopic Sinus Surgery (ESS) is considered the contemporary standard of care of the chronic rhinosinusitis in adults. Nasal and Paranasal spaces anatomy in children was changes dramatically with growing, making endoscopic sinus and skull base surgeries challenging and risky (Margo, 2009). In children, endoscopic techniques have been used for treatment of chronic rhinosinusitis, complicated acute sinusitis, sinus tumor, meningoceles and congenital sinonasal malformations.

The usage of image technique during surgery will make it safer and will be more guided intraoperatively with fewer complications (Mathieu, 2015). The indications of image-guided surgery (IGS) include revision sinus surgery, distorted sinus anatomy of developmental, postoperative, extensive sinonasal polyposis, traumatic origin, posterior ethmoid, pathology involving the frontal, and sphenoid sinuses, diseases abutting the (orbit, skull base, carotid artery, or optic nerve), benign and malignant sinonasal neoplasms and CSF rhinorrhea with skull base defects (Timothy, 2007).

2. METHODOLOGY

This is a retrospective clinical study which was conducted in the otolaryngology department of king Fahad specialist hospital, Saudi Arabia from (2009-2019) of all cases of image guided pediatric endoscopic Sinus & Skull base Surgeries in a group of patients between 4-15 years of age, patients included show less morbidity and intra-operative complications the patients who included were had complicated & non-complicated allergic fungal sinusitis and other complicated conditions such as intra-sinuses tumors and it was highly successful procedure.

3. RESULTS

47 patients (4-15 years old) underwent endoscopic sinus surgery using optical and radio magnetic navigation systems.

The indications include:

15 patients with allergic fungal sinusitis abutting the orbit and skull base, 14 patients with complicated sinusitis (acute sinusitis, recurrent, chronic), 4 patients with mucopyoceles, 4 patients with ethmoidal meningoceles, 4 patients with rhabdomyosarcoma affecting the infratemporal fossa, seller and paraseller regions, 3 patients with angiofibroma, 1 patient with frontal CSF leak, 1 patient with pituitary cyst and 1 patient with chronic invasive fugal sinusitis.

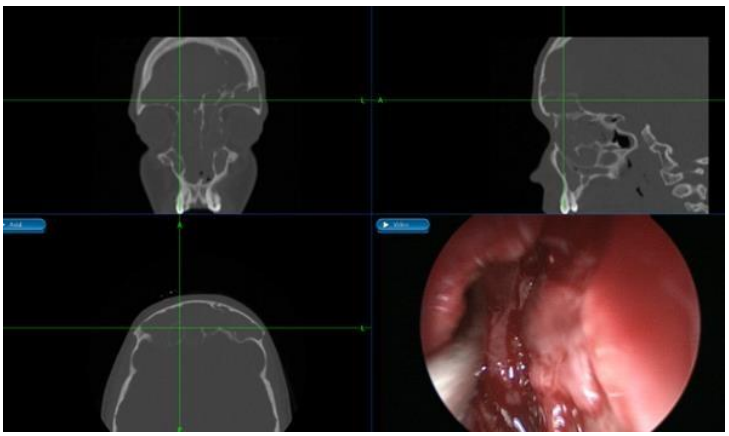

Figure 1: IGS in Frontal mucin drainage. This is a sagittal, coronal view with utilization of image guided endoscopy for a patient that shown a mucin.

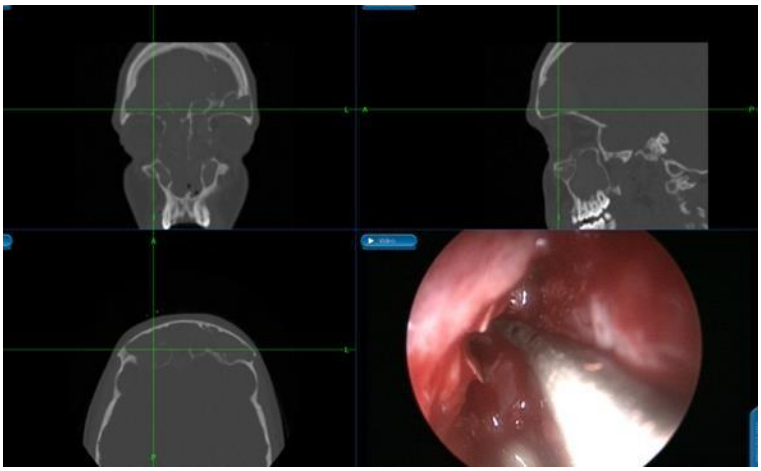

Figure 2: IGS in wide frontal sinus dissection in extensive allergic fungal sinusitis. Coronal and sagittal view with endoscopic management of frontal sinuses to remove fungal debris and muci in the affected sinus.

4. DISCUSSION

Intranasal and skull base surgeries in pediatrics is characterized by the variety of important vascular and neural structures within a narrow operating field. Although preoperative imaging by computed tomography (CT), magnetic resonance imaging (MRI) and the use of microsurgical techniques have improved intraoperative orientation, a large number of complications are still caused by localization problems. Especially in pediatric skull base surgery, maximum localization accuracy during surgery is required (Klimek, 1995, Florence Postec, 2002). Direct visualization of anatomical landmarks is essential for accurate instrument positioning during ESS. However, when anatomical structures are distorted or absent due to previous surgeries or advanced pathology, the risk of iatrogenic injury is increased. In order to avoid such complications, image- guided surgery (IGS) was introduced (Parikh, 2009).

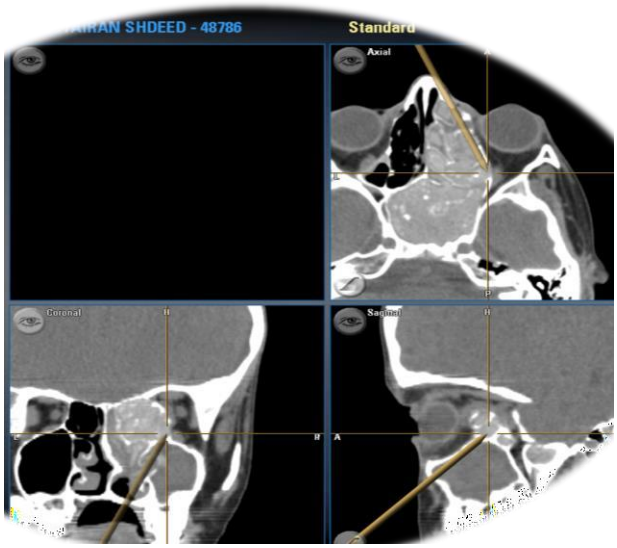

Figure 3: IGS in allergic fungal sinusitis abutting orbit.

AAO-HNS policy on intraoperative use of computer-aided surgery, American Academy of Otolaryngology–Head and Neck Surgery 2005 (Timothy, 2007)

1. Revision sinus surgery (RSS).
2. Distorted sinus anatomy of developmental, postoperative, or traumatic origin.
3. Extensive sinonasal polyposis.
4. Pathology involving the frontal, posterior ethmoid, and sphenoid sinuses.
5. Disease abutting the optic nerve, skull base, carotid artery, or orbit conditions where there is a skull base defect or CSF rhinorrhea.

6. Sinonasal neoplasms.

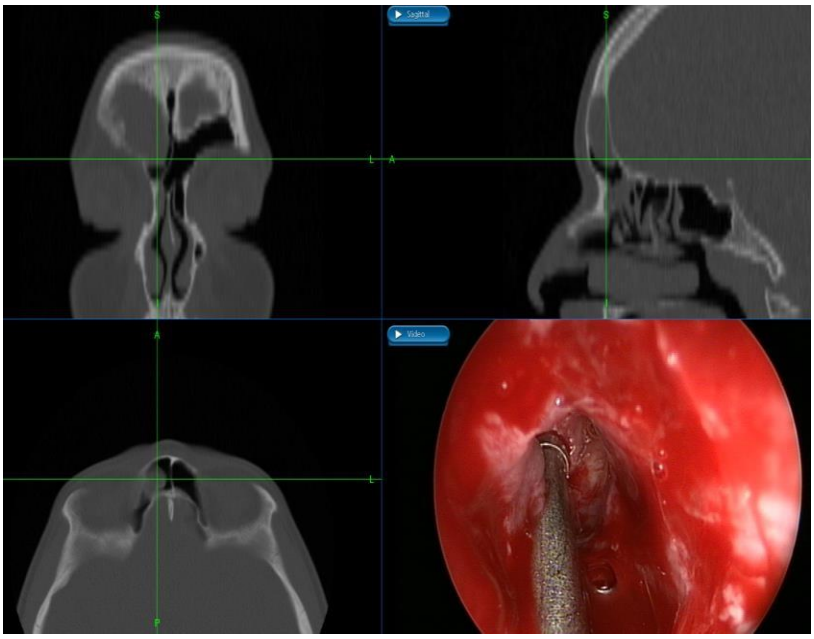

Figure 4: IGS in frontal mucocele drainage.

We have used imaging guides in different age group range between 4 to 15 years. Most of our cases due to non-complicated allergic fungal sinusitis (figure 1, figure 2), Complicated allergic fungal sinusitis (figure 3), Chronic invasive fugal sinusitis, Mucopyoceles (figure 4), Frontal CSF leak, Ethmoidal meningoceles, Pitutiary cyst, Angiofibroma & Rhabdomyosarcoma affecting the infratemporal fossa, seller and paraseller region (figure 5). Utilization of IGS was also found safe in our experience, as no intra- or postoperative complications were reported. The average rate of complications reported in the literature ranges between 0.6% and 4% (Hebert, 1998, Han, 2003). The complication rate may depend on the surgeon's expertise, thus making comparisons difficult (Reardon, 2002). The main issue that we faced is the time consumed for perioperative setup of the (IGS) that also mentioned in other studies (Orlandi, 2004, Wolfgang Koele, 2002, Caversaccio, 2002).

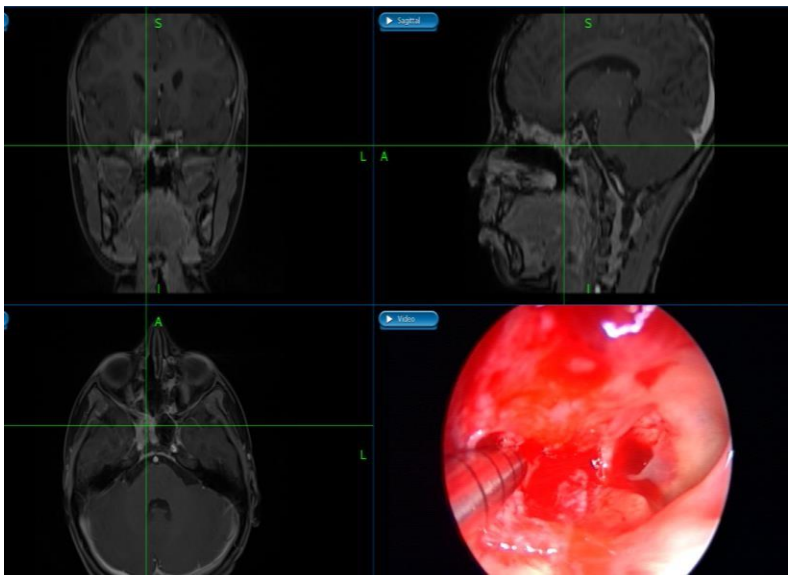

Figure 5: IGS in sphenoidal tumor approached by endoscopic image guided.

5. CONCLUSION

Image guidance system (IGS) is effective and safe tool that improve endoscopic approach in pediatric sinonasal and skull base surgeries with minimal morbidity and intraoperative complications. However, the indications of image guidance in our study included allergic fungal sinusitis abutting orbit and skull base, different complicated sinusitis with periorbital and brain abscesses, CSF leaks and meningocele and different benign and malignant tumors affecting the orbit, infratemporal fossa and skull base and that show the successful of image guidance method in children.

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Finding:
This study has not received any external funding.

Conflict of interest:
The authors declare that there is no conflict of interest regarding the publication of this paper.

Informed consent:
Oral informed consent was obtained from all individual participants included in the study.

Ethical approval:
The study was approved by the Medical Ethics Committee of King Fahad Specialist Hospital-Dammam (ethical approval code: SUR0379).

Data and materials availability:
All data associated with this study are present in the paper.

Peer-review: External peer-review was done through double-blind method.

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