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Case Report Open Access

The Use of Virtual Endoscopy for Diagnosis of Traumatic Supra-glottic Airway Stenosis

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Case Presentation

A 30-year-old lady, who works as a flight attendant at one of the global leading airway company, was referred to Otolaryngology Unit in Rumailah Hospital, complaining of progressive hoarseness of voice over the period of few months. She states that her work as stressful, but no history of any voice misuse. She has recently quitted smoking for 5 months. She has denied any fever, cough, recent URTI or constitutional symptoms like loss of weight, nausea, anorexia and fatigue. She excludes any allergy or any chronic medical illness. Her history reflects significant front neck trauma which was blunt in nature. It happened 3 months ago. Mechanism of injury was, overhead bin fallen suddenly on his neck while she was trying to secure it. As a result, she developed sudden change in voice and sore throat; she was referred for urgent neck CT report indicated the following results,

- Thickening of the right aryepiglottic fold with encroachment on the right piriform fossa.
- Along with 1.5 cm air-filled track to the right of the anterior commissure at the level of the true vocal cord.
- It is possibly communicated with the laryngeal cavity with mild surgical emphysema.
- Rest of laryngeal skeleton is normal.

The patient underwent emergency removal of floating left false vocal cords and repair of ruptured left true vocal cords, the airway management was uneventful, mask ventilated and intubated easily using direct laryngoscopy mac 3 after one attempt. ETT tube size 6 mm cuffed, secured at 20 cm. The patient was discharged home and was given appointment for future follow up.

On her recent visit, the patient's lab was within normal limit, a recently done CT (Figure 1 and 2) showed an evidence of asymmetry of the vocal cords with triangle-shaped structure (web) seen in the right vocal cord, a symmetry of the thyroid cartilage. Otherwise, normal looking epiglottis, arytenoids and cricoid cartilages.

Figure 1: Coronal section shows the irregularity in the airway caliber, image courtesy Dr. Nabil Shallik.

Figure 2: Transverse (axial) section shows glottic stenosis otherwise normal laryngeal bony structure, image courtesy Dr. Nabil Shallik.

The nasoendoscopy revealed constriction in the supraglottic area, without any clear demarcation of the glottis structure or the vocal cords, was labelled as post traumatic glottis stenosis for surgical release (Figure 3).

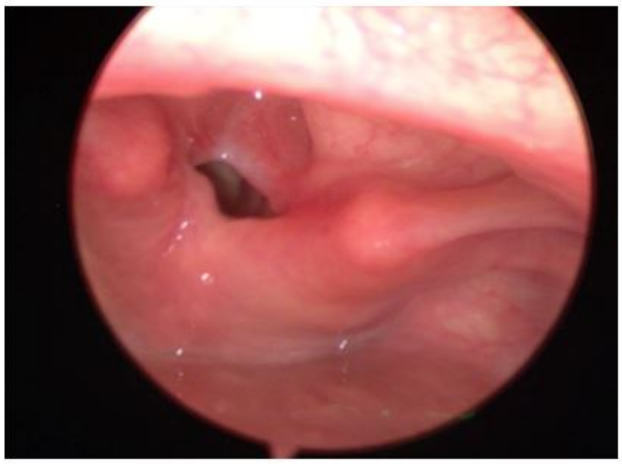

Figure 3: Flexible fibrotic view showing stenotic glottic opening, Image courtesy Dr. Nabil, Shallik, RH.

The preoperative anesthesia visit revealed a healthy female with a neck circumference within normal limit, a temporo-mandibular distance more than 6 cm, a Mallampati score of 1 with adequate mouth opening of more than 4 cm. The scenarios of difficult airway were addressed, however she did not agree about the option of awake fibreoptic intubation and she consistently refused the tracheostomy as life saving measure in case of the difficult airway, as she was concerned to lose her job. The preoperative reconstructive 3D images and virtual endoscopy were used to assess the caliber of stenosis and its extension, so it could facilitate the airway decision. The images were reconstructed by Osirix V.13 showed a supra-glottic stenosis with no infra-glottic extension and normal true vocal cords (Figure 4).

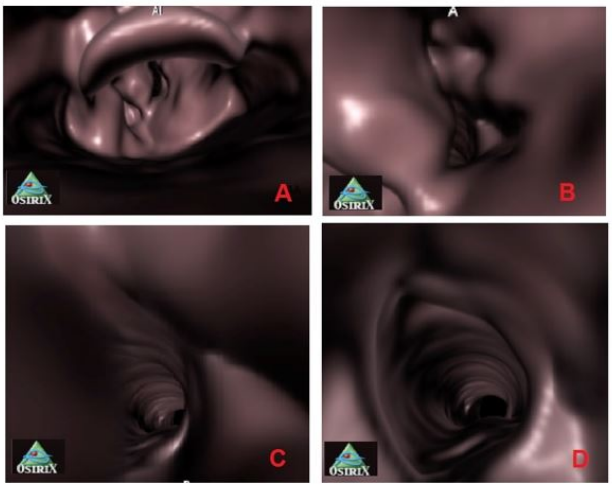

Figure 4: Preoperative 3D reconstructive by Osirix software, A: Supraglottic stenosis, with no visualization of the vocal cords, B: At stenotic level, C: Just beyond stenotic level, D: Intratracheal images, Image Courtesy; Dr. Nabil Shallik.

The anesthetic management was eventful for difficult airway, intubated after three attempts using awake fibreoptic intubation then video-scope (video-assisted fibreoptic intubation VAFI technique). Topicalizaion of airway done by combination of 4% lidocaine nebulization, atomization spray to tongue, and oropharynx followed by "spray as we go" through the working channel of the scope using epidural catheter and was very effective as no gage reflex or any other sign of discomfort. The initial 4.5 cuffed ETT did not pass the stenosis, so another successful attempt with 4.0 ETT was done but after insertion we found it very short, the last trial done using 4.0 nasal EET and the ETT was extended using warm water to become more elongated and connected to anesthesia machine. The patient was kept anesthetized by TCI Propofol and Remifentanil all over the procedure. Rapid and smooth emergency with awake extubation was successful.

Discussion

Airway management for traumatic airway has been challenging, as it is always anticipated as a difficult airway in a complex patient in an emergency. Airway injury has been associated in different studies with the highest mortality rate, as it was explained by the association with degree of trauma severity, rather than fatal airway complications. As an isolated airway injury still rare in traumatic patients, reported less than 1%, still there are no obvious guidelines or consensus for its assessment and management [1-8]. As the evidence is lacking as far as, the choice of management is concerned, however it has been entirely depending on the patient's condition, institutional settings, skills of expertise and availability of equipment's.

We present an airway trauma case that suffered for the first time with an isolated blunt laryngeal trauma of moderate severity with signs of dysphonia, sore throat and radiological finding of air tack outside larynx and neck emphysema but no hemodynamic or respiratory sequelae. The patient kept under observation and underwent surgical repair on the next day. The airway management involved face mask, DL by Macintosh, Mac 3.0 and ETT 6.0. The second visit three months

later, showed signs of dysphonia as a post traumatic laryngeal complication. The fibreoptic assessment revealed a large glottic band with no obvious true vocal cord. As patient was uncooperative, she refused the option of awake fibreoptic intubation but accepted to do under mild sedation. To assess the caliber of the band and the nature of extension we used a Virtual endoscopy (VE) technique by OsiriX V 13, an image processing software dedicated to DICOM images, to generate "flying through" reconstructive images 3D reconstructive images has been widely used in different surgical and medical specialties. The techniques gained popularity in orthodontics, maxillofacial reconstructive surgery, where it has showed great benefit to assess the reconstruction plan in pharyngeal and laryngeal surgeries. Fibreoptic-endoscopy (NE) is considered as an ideal preoperative assessment tool for upper airway especially when the suspected abnormality is chronic and of non-urgent nature. Thus, the potential area of obstruction is pre-defined and clear airway strategy is pre-planned. However, naso-endoscopy comes with its own limitations as it is invasive procedure, requires extensive training and high learning curve, limited to above level of glottis and could be poorly tolerated in some patient populations even in experienced hands [9,10].

Recently the reconstructive techniques have been introduced as a novel technique for upper airway assessment. The main advantage of reconstructive images that It offers non-invasive high-quality images like NE, thus avoiding the failure and complications of NE without any additional radiation or discomfort for the patients. The reconstruction process produces a 360° navigation view that accurately and safely maps the upper airway for preoperative planning. Virtual endoscopy has been studied in assessing various airway pathologies and has been to be equivalent to naso-endoscopic images in supraglottic, glottic, subglottic, and complex multilevel airway pathology [11].

Different studies have reported high sensitivity for the VE images reaching 100% for detecting stenotic and obstructive lesions. Other advantage of VE that it could be used in training and research on normal and abnormal airway anomalies and various airway scenarios [12].

Market al described that novel technique of images reconstruction for VE is costly and time consuming in comparison to rapid fibreoptic NE [13]. However, the other authors have reported that Osiri X software is free, easy, user-friendly and time efficient of average 10-20 min for image reconstruction [11].

Conclusion

There is destitution of evidence based guidelines in post-traumatic airway management in stable patients. Alternatively, the best practice mandates a consideration of global clinical condition, obtaining high level of suspicion of airway inadequacy. Above all, effective utilization of equipment and resources has a pivotal role. The Virtual Endoscopy, 3D reconstructive upper airway imaging is a novel non-invasive tool that could be helpful in the situation where the anatomical lesions in the upper airway cannot be assessed by a simple visualization technique. On-invasive high-quality images like fibreoptic could be obtained in situation when the patient cooperation or fitness is not possible. VE offers an objective preoperative assessment of the airway at different levels with quantification of the airway caliber and severity of the stenosis that could impact the decision of the airway management.

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