Volume 8, Nomor 2, Agustus 2024 **ISSN 2623-1581 (Online)**
ISSN 2623-1573 (Print)

AWAKE FIBEROPTIC INTUBATION WITH SAYGO APPROACH ON A PATIENT WITH SEVERE ANTERIOR MENTOSTERNAL CONTRACTURE (ONAH TYPE III) UNDERGOING RECONSTRUCTION SURGERY

Ferdinand Ferry[1*], Otniel Adrians Labobar[2], Marilaeta Cindryani Ra Ratumasa[3], Tjokorda Gde Agung Senapathi[4]
Anesthesiology and Intensive Care Department, Medical Faculty of Udayana University/Prof Ngoerah General Hospital, Denpasar, Bali, Indonesia[1]
Anesthesiology and Intensive Care Department, Medical Faculty of Udayana University/Prof Ngoerah General Hospital, Denpasar, Bali, Indonesia[2]
Anesthesiology and Intensive Care Department, Medical Faculty of Udayana University/Prof Ngoerah General Hospital, Denpasar, Bali, Indonesia[3,4]
[*]*Corresponding Author* : frdbius2022@gmail.com

ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi efektivitas teknik intubasi fiberoptik pada pasien terjaga (Awake Fiberoptic Intubation, AFOI) dalam manajemen jalan napas pada pasien dengan kontraktur leher parah akibat jaringan parut pasca luka bakar. Penelitian ini menggunakan desain studi kasus deskriptif untuk menggambarkan secara rinci manajemen anestesi dan intervensi bedah pada pasien dengan kontraktur leher parah akibat jaringan parut pasca luka bakar. Subjek penelitian adalah pria berusia 35 tahun dengan riwayat luka bakar yang menyebabkan kontraktur leher dan deformitas sekunder pada wajah. Data dikumpulkan melalui pemeriksaan fisik, evaluasi radiografi, dan penilaian menggunakan kriteria seperti MOANS, LEMON, RODS, dan SMART untuk menilai tantangan yang dihadapi pasien. Data terkait manajemen anestesi, proses intubasi, dan intervensi bedah dicatat secara rinci selama operasi, termasuk tanda vital, pemberian obat, dan hasil intraoperatif. Data yang terkumpul akan dianalisis secara deskriptif untuk menggambarkan kondisi klinis pasien sebelum dan sesudah intervensi, serta untuk mengevaluasi efektivitas prosedur anestesi dan bedah yang dilakukan. Hasil analisis akan disajikan dalam bentuk naratif, didukung oleh gambar klinis preoperatif, evaluasi radiografi, dan hasil postoperatif. Hasil penelitian menunjukan bahwa berbagai tes dapat memprediksi jalan napas sulit, dan kasus ini dapat dikelola sesuai pedoman ASA. Teknik AFOI, yang mencakup premedikasi, anestesi lokal, dan sedasi, memiliki tingkat keberhasilan tinggi dan risiko komplikasi rendah. Topikalisasi yang tepat dan infus dexmedetomidine efektif menumpulkan refleks jalan napas dan menjaga stabilitas hemodinamik. Dalam kasus ini, AFOI berhasil dilakukan melalui lubang hidung kiri dengan pasien tetap tenang, terjaga, dan kooperatif.

Kata kunci : AFOI, *contracture, intubation*, ONAH, SAYGO

ABSTRACT

This study aims to evaluate the effectiveness of the Awake Fiberoptic Intubation (AFOI) technique in airway management for patients with severe neck contractures due to post-burn scar tissue. The subject is a 35-year-old male with a history of burns that caused neck contractures and secondary facial deformities. Data were collected through physical examinations, radiographic evaluations, and assessments using criteria such as MOANS, LEMON, RODS, and SMART to evaluate the challenges faced by the patient. The study findings indicate that various tests can predict difficult airways, and these cases can be managed according to ASA guidelines. The AFOI technique, which includes premedication, local anesthesia, and sedation, has a high success rate and a low risk of complications. Precise topicalization and dexmedetomidine infusion effectively blunt airway reflexes and maintain hemodynamic stability. In this case, AFOI was successfully performed through the left nostril with the patient remaining calm, awake, and cooperative.

Keywords *: AFOI, intubation, SAYGO, contracture, ONAH*

INTRODUCTION

Difficult intubation occurs in 1.5% to 8% of patients undergoing elective surgery under general anesthesia, with inadequate airway management could lead to respiratory events resulting in permanent cerebral damage or death due to hypoxia (Apfelbaum et al., 2022). The American Society of Anesthesiologists (ASA) Task Force defines difficult endotracheal intubation as requiring more than three attempts or more than 10 minutes with conventional laryngoscopy. Difficult Airway Society (DAS) guidelines defined difficult airway as as 'the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation, or both' (Kamal et al., 2023).

Post-burn neck contractures (PBC) and deformities can extend to involve the face and chest, exerting traction forces that lead to insufficient neck extension, oral occlusion problems, lower lip eversion, lower lid ectropion, airway anatomy distortion, and cervical spine misalignment (Bhatnagar & Singh, 2020; Dhua & Raheel, 2022). The reconstruction surgery commonly use nasotracheal intubation for better surgical visualization and oral cavity access. Not only PBC restrict cervical range of motion but also impact lower facial function and may induce tracheal alterations and cervical spine distortion. Distorted airway anatomy and cervical spine issues can complicate intubation, potentially leading to life-threatening situations like "cannot ventilate, cannot intubate," with numerous serious complications and sequelae (Sabapathy et al., 2022).

Recommended approaches for managing airways in patients with difficult intubation needing awake tracheal intubation (ATI) include awake fiberoptic intubation (AFOI) techniques.[7] Even with many increasingly popular intubation devices, such as video laryngoscope, they may not be suitable for patients with limited mouth opening due to space requirements or risk of tissue damage.[8] The aim of this study is to investigate and document the process and outcomes of airway management in a patient with severe anterior mentosternal contracture (ONAH Type III) who undergoes neck contracture release and reconstruction surgery with a flap procedure. This study aims to evaluate the effectiveness of Awake Fiberoptic Intubation (AFOI) techniques in managing the airway of a patient with severe neck contractures resulting from post-burn scar tissue.

METHOD

This study employs a descriptive case study design, aimed at providing a detailed account of the anesthetic management and surgical intervention in a patient with severe neck contractures resulting from scar tissue due to burns. The subject is a 35-year-old male weighing 53 kg, with a height of 150 cm and a body mass index (BMI) of 23.56 kg/m². The patient has a history of burns sustained 24 years ago, leading to severe neck contractures and secondary deformities affecting the lips, eyes, and lower jaw. Data were collected through physical examinations, radiographic evaluations, and assessments using various criteria such as MOANS, LEMON, RODS, and SMART to evaluate the challenges associated with the patient's condition. Detailed data on anesthetic management, the intubation process, and surgical intervention were recorded during the operation. Vital signs, medication administration, and intraoperative outcomes were meticulously documented as part of the monitoring process during and after the surgery. The collected data will be analyzed descriptively to portray the patient's clinical condition before and after the intervention, and to assess the effectiveness of the anesthetic and surgical procedures in addressing the contractures and deformities. The results of this analysis will be presented in a narrative format, supported by preoperative clinical images, radiographic evaluations, and postoperative outcomes.

RESULTS

A 35-year-old male, with weight of 53 kg, height 150 cm, and body mass index of 23.56 kg/m^2 presented with severe neck contractures due to scar tissue from burns sustained 24 years ago, resulting in restricted movement and secondary deformities affecting the lips, eyes, and lower jaw. He was currently able to mobilize independently and able to had normal oral intake. Physical examination showed significant contractures and limitations in mobility across various regions. Notably, in the facial-colli region, scar contractures were diffuse, spanning from the right side measuring 9 cm x 6 cm to the left side measuring 15 cm x 7 cm, with an elevation of 1-5 mm. Additionally, the patient exhibited drooling, likely due to the contractures affecting oral function, and post-burn ear deformity was noted.

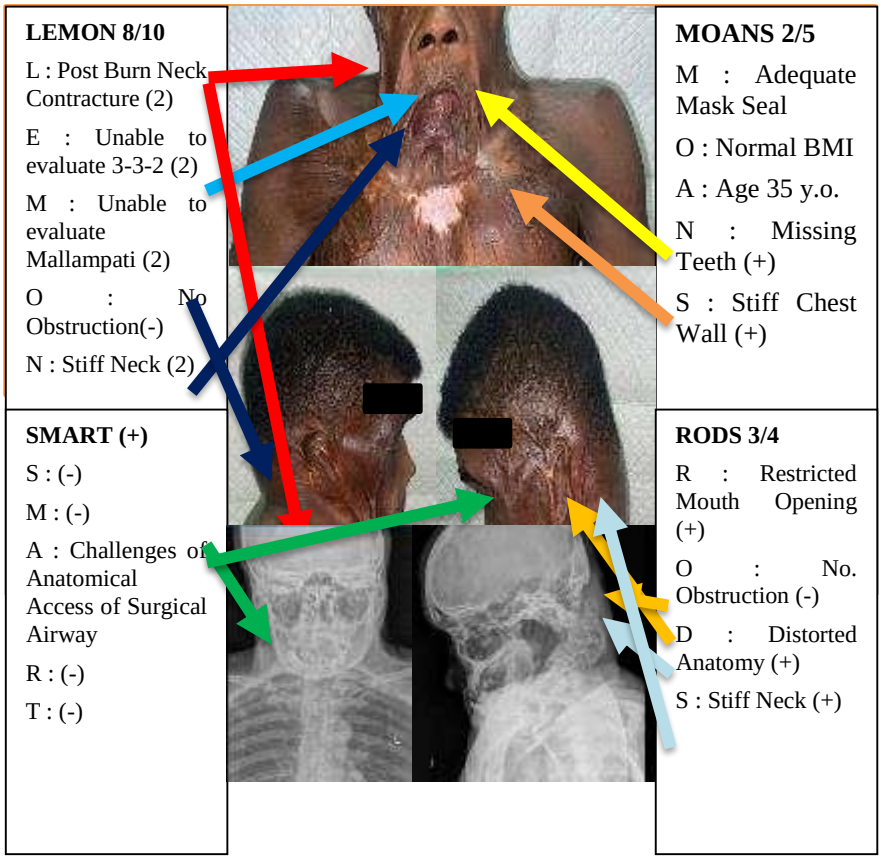

Figure 1. Clinical Preoperative Presentation, Radiographic Evaluation and Airway Asessment

As seen in figure 1, assessment using various scoring criteria further highlighted the challenges posed by the patient's condition. According to the MOANS criteria, while mask seal were deemed adequate and there was no airway obstruction, the presence of missing teeth and stiff chest wall due to contracture contributed to a score of 2 out of 5. Evaluation based on the LEMON criteria emphasized on the observed severe anterior mentosternal contracture in the neck region, causing inability to evaluate of mouth opening, mandibular space, and glottis position also the Mallampati score, and stiff neck mobility with range of motion (ROM) at flexion at 50°, extension at 20°, and rotation at 60° to both sides in the neck, resulting in a score of 8 out of 10. The RODS criteria, has found the patient with limited mouth opening, and anatomy distortion that caused stiffness of the cervical spine as seen on the cervical AP/lateral radiograph, anterior compression at the level of cervical vertebra 3-4 was identified. This compression resulted in a kyphotic deformity, which refers to an abnormal forward curvature of the spine in the cervical region, scored 3 out of 4. Additionally, the SMART criteria scored

1 out of 5, indicating challenges related to anatomical access of surgical airway due to distorted anatomy caused by the contracture.

The patient was a woodworker, engaging in moderate to heavy activities daily. The patient was an active smoker with a history of 20 years of smoking, consuming 4 cigarettes per day. The other physical examination, thoracic radiograph and laboratory tests showed relatively normal results. The diagnosis for anesthesia management involves classifying the patient as ASA III, indicating a moderate-to-severe pre anesthesia condition.

The surgical diagnosis was a postburn mentosternal contracture classified as ONAH Type III. This includes diffuse flexion contractures involving the neck, anterior thorax, and upper extremities, along with linear contractures in the axillary regions. Surgical intervention planned includes the release of neck contracture combined with reconstructive procedures utilizing either local flap or anterolateral thigh (ALT) free flap.

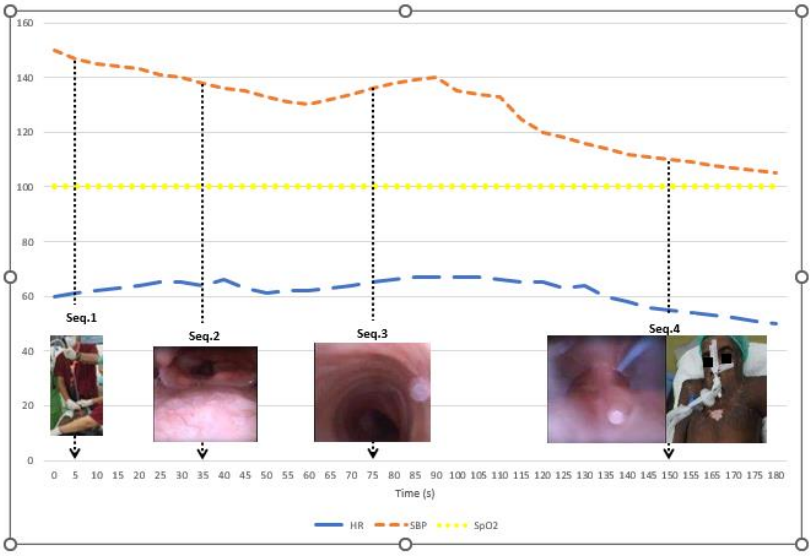

Figure 2. Summarizes The Hemodynamic Profile and Key Sequences During Awake Intubation Using A Flexible Scope

A comprehensive treatment plan was created to address the challenges posed by the patient's condition. Anesthesia management involved the use of general anesthesia with careful consideration of the difficult airway. When the patient arrived at the reception room, vital signs are measured, and nebulization 3 ml of lidocaine 4% (120 mg) solution was given to the patient, followed by oxymetazoline 0.05% solution and lidocaine 10% solution sprayed on both nostrils (10 mg each nostril). Afterwards, in the operating theatre before intubation process, lidocaine 10% solution sprayed to the patient's oral cavity and throat (total of 30 mg). As seen in Figure 2 Sequence 1, the flexible intubating scope of choice the fiberoptic scope was used to facilitate airway access, dexmedetomidine has been infused and titrated at a dose of 50 mcg (~1mcg/kg body weight) over 10 minutes. In Sequence 2 (35^{th} second), after successful visualization of vocal cords, lidocaine 2% solution (40 mg) sprayed directly using spray-as-you-go (SAYGO) approach via fiberoptic scope also intravenous (IV) lidocaine 80 mg was given, followed by Sequence 3 (75^{th} second) insertion of fiberoptic scope through into trachea. At Sequence 4 (150^{th} second) intubation was done with a non-kinking endotracheal tube (ETT) internal diameter size 7.0, visualized with a flexible intubating scope while keeping the patient awake and complied to instruction. After confirming symmetric lung expansion, IV propofol 100 mg, fentanyl 150 mcg, and rocuronium 50 mg were administered. Intraoperatively, dexmedetomidine maintenance infusion was at 0.8mcg/kg/hour, propofol infusion at a rate of 10ml/hour (~33mcg/kg body weight/minute), and intermittent fentanyl boluses of 25 mcg every 45 minutes.

Surgical intervention focused on releasing the contractures and reconstructing the affected areas. Additional medications included IV paracetamol 1000mg, ibuprofen 400mg, and ondansetron 8mg. During the operation, general anesthesia was maintained for a duration of 4 hours and 30 minutes. Hemodynamic fluctuations were uneventful, with blood pressure ranging from 82 to 113/62 to 85 mmHg, heart rate from 65 to 87 beats per minute, respiratory rate from 16 to 18 breaths per minute, and oxygen saturation maintained between 99% and 100%. Fluid management included the administration of 2000 ml of Ringer's lactate solution. There were no blood components administered intraoperatively. Urine output was 200 ml, and there was an estimated blood loss of 1500 ml. At the end of surgery, patient is emerged from the general anesthesia with spontaneous breathing and adequate tidal volume and without any sign of delirium or pain. The patient was extubated and sent to the post anesthesia care unit (PACU). Afterwards, postoperative care included monitoring in an intermediate care unit to ensure optimal recovery and management of any complications.

Figure 3. Post Operative Results After Neck Contracture Release and Reconstruction Surgery with Flap

DISCUSSION

Difficult airway assessments aid in preoperative prediction of difficult airways, helping anesthesiologists formulate appropriate airway management plans to ensure patient safety during anesthesia. A difficult airway may prohibit mask ventilation or increase the risk of a failed intubation attempt.[2] Various tests exist to predict difficult laryngoscopy and intubation. Bedside tests such as Mallampati grading, interincisor gap, thyromental distance, sternomental distance, upper lip bite test, neck circumference, and atlantooccipital extension are commonly used (Kamal et al., 2023).

Patients with neck contractures pose a significant challenge for intubation, and failure to intubate them can lead to considerable morbidity and even mortality. Anesthesiologist evaluate the degree of intubation difficulty using various physical signs, scores, and radiologic imaging.(Agarwal et al., 2021) The Modified Mallampati Test assesses oropharyngeal visibility upon maximal mouth opening. Class I indicates a clear view of the soft palate, hard palate, uvula, and tonsillar pillars, while Class IV suggests only the hard palate is visible. Thyromental Distance measures the distance between the thyroid cartilage and the mentum, with Grade 1 (>6.5 cm) indicating easy intubation, Grade 2 (6.0-6.5 cm) implying difficulty but possibility, and Grade 3 (<6 cm) suggesting intubation may not be possible (Jain et al., 2024; Trambadia et al., 2023).

Difficult Airway Society (DAS) guidelines for intubation focus on unanticipated difficult intubation. However, in this case the difficult airway situation is expected, hence the recently published 2022 American Society of Anesthesiologists (ASA) guidelines for managing the difficult airway is more preferable. ASA guidelines used the decision tree tool to choose between pathways. The primary focus of these guidelines is the management of the difficult airway encountered during administration of anesthesia and tracheal intubation. The ASA guidelines for difficult airway management in adult patients are shown in Figure 4.[1]

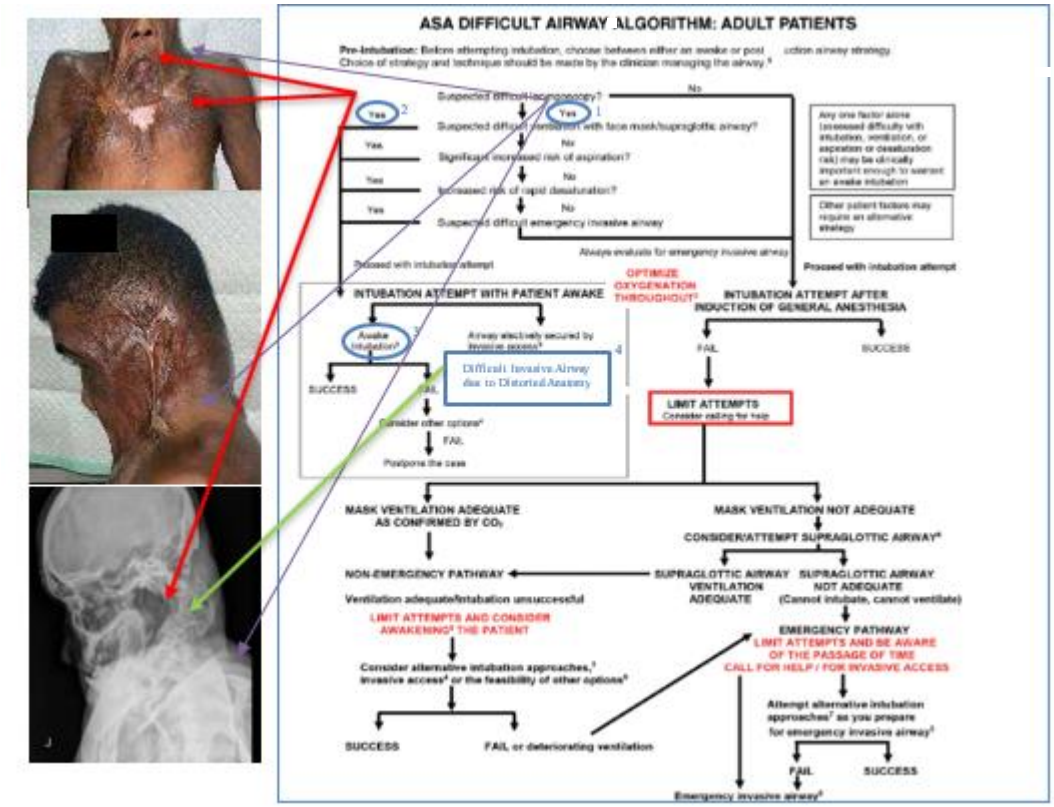

Figure 4. ASA Guidelines For Difficult Intubation and Decision Tree Tool

Using the ASA decision tree tool, in Figure 4[1] the predictors of difficult intubation are encapsulated in the mnemonic "LEMON", representing difficult external appearance (L), the "3-3-2 score" assessing mouth opening, mandibular space, and glottis position (E), the Mallampati score (M), obstruction (O), and limited neck mobility (N).(Saoraya et al., 2021) In this study, difficult laringoscopy is suspected through the results of LEMON criteria score of 8 out of 10. Evaluation based on the LEMON criteria emphasized on the observed severe anterior mentosternal contracture in the neck region, causing inability to evaluate of mouth opening, mandibular space, and glottis position also the Mallampati score, and stiff neck mobility with range of motion (ROM) at flexion at 50°, extension at 20°, and rotation at 60° to both sides in the neck.

On the next step of ASA decision tree tool, in Figure 4[2] difficult bag-mask ventilation predictors are represented by "MOANS", indicating suboptimal mask seal (M), obstruction or obesity (O), advanced age (A), absence of teeth (N), and lung stiffness (S).(Saoraya et al., 2021) According to the MOANS criteria, while mask seal were deemed adequate and there was no airway obstruction, the presence of missing teeth and stiff chest wall due to contracture contributed to a score of 2 out of 5. A review by Jung H. A (2023) reported a significant observational study found that utilizing modified LEMON and MOANS criteria demonstrated

a sensitivity of 85.7% in predicting difficult intubation and bag-mask ventilation.(Jung, 2023) Another part in Figure 4[2], the mnemonic RODS can be used to predict difficulty in either placing a supraglottic airway (SGA) or in providing adequate gas exchange through one. RODS stands for Restriction, Obstruction/Obesity, Disrupted or Distorted anatomy, and Short thyromental distance (Simon & Torp, 2024). Ventilation access through SGA was deemed difficult too through the results of the RODS criteria. The RODS criteria scored 3 out of 4 with limited mouth opening, and anatomy distortion that caused stiffness of the cervical spine as seen on the cervical AP/lateral radiograph, and anterior compression at the level of cervical vertebra 3-4 that resulted to abnormal forward curvature of the spine.

According to the ASA guidelines, seen in Figure 4[3], difficult laryngoscopy and ventilation with facemask/SGA warranted an attempt on awake intubation. Another way recommended by ASA in Figure 4[4], for securing the airway through the means of invasive access such as cricothyrotomy cannot be done in this patient, considering the distorted airway anatomy. The SMART criteria assessed five factors related to difficult cricothyrotomy, namely surgery, mass, access or anatomy, radiation, and tumor (Brown et al., 2022). This case indicated challenges related to anatomical access of surgical airway due to distorted anatomy caused by the contracture, hence scoring 1 out of 5 in the SMART criteria.

Airway management of an anticipated difficult airway consists of interventions addressing ATI, anesthetized tracheal intubation, or both. General recommendations include AFOI, awake video laryngoscope, using a laryngeal mask airway as an intubating conduit, lightwand, oral or nasal blind intubation, retrograde intubation, invasive airway access, and ECMO, which is considered the last resort (Wang et al., 2021). In this patient, ATI was chosen as the intubation method. ATI has a high success rate and a low-risk profile and has been cited as the gold standard in airway management for a predicted difficult airway.(Ahmad et al., 2020)

When managing a predicted difficult airway where tracheal intubation is necessary, AFOI remains the preferred method, especially if mask ventilation is anticipated to be challenging. This approach maintains spontaneous breathing, reducing the risk of critical desaturation or a "cannot intubate-cannot oxygenate" situation. It is highly reliable in difficult airway cases, particularly when ventilation is difficult or impossible, with a success rate between 88% and 100%, largely depending on the operator’s experience. Complications are generally mild and infrequent (Cabrini et al., 2019).

The AFOI technique involves three sequential steps: premedication, local anesthesia, and sedation. For an ideal AFOI, the patient should be calm, cooperative, and have blunted airway reflexes to facilitate easy intubation. This requires providing adequate anxiolysis, analgesia, and topical anesthesia to the airway without causing respiratory depression. Dexmedetomidine, popular for conscious sedation, also offers anxiolytic, amnestic, analgesic, and antisialagogue properties, and it preserves respiratory function even at high doses(Verma et al., 2021). In this case, dexmedetomidine infusion was administered in titrated dose of 50 mcg over 10 minutes.

Achieving effective anesthesia in the upper airway involves precise topicalization, where local anesthetic agents are applied directly to specific areas to numb relevant nerves and tissues responsible for sensations like gagging, swallowing, and coughing. This process, often performed using nebulization, sprays, gels, or swabs containing agents like lidocaine or benzocaine, targets the oropharynx, nasopharynx, and larynx, ensuring comfort for the patient and reducing reflexive responses during procedures such as intubation or airway manipulation. Precise topicalization not only enhances patient comfort but also plays a critical role in ensuring the safety and success of interventions involving the upper airway, allowing healthcare providers to perform procedures smoothly and with fewer complications (Mishra et al., 2022; Mittal et al., 2024). In this case, topicalization was done using 120 .mg of lidocaine 4% solution via nebulization, 50 mg of lidocaine 10% solution sprayed on the nostrils, nasal cavity, oral cavity and throat, 40 mg of lidocaine 2 % solution sprayed on vocal cords via SAYGO

approach, and IV 80 mg of lidocaine. Finally, the insertion of the fiberoptic bronchoscope and the endotracheal tube done using non-kinking endotracheal tube (ETT) size 7.0 via left nostrils. After successful intubation, general anesthesia was administered after confirming symmetric lung expansion using propofol 100mg, fentanyl 150mcg, and rocuronium 50mg IV. Intraoperatively, additional agents were administered including dexmedetomidine maintenance drip was at 0.8mcg/kg/hour, propofol infusion at 10mg/ml at a rate of 10ml/hour (~33mcg/kg/minute), and intermittent fentanyl boluses of 25mcg every 45 minutes.

A randomized controlled trial in cadaver by Groombridge et al. (2022) was conducted to compare intubation time by emergency physicians without iatrogenic airway trauma through a supraglottic airway device (SAD) using a retrograde intubation technique (RIT) versus using a flexible airway scope (FAS). The results showed that the mean time to intubation was significantly shorter in the FAS group at 18.2 seconds compared to 52.9 seconds in the RIT group. (Groombridge et al., 2022)

Successful use of AFOI in post burn contracture cases has been reported in various studies. Sahoo and Vig (2023) performed AFOI in the ovassapian airway using 7 mm of the flexometallic tube (FMT) threaded over the fiberoptic. The previous attempts had failed because of the inadequate depth of local anesthesia provided that made the patient noncompliant upon introduction of the scope. Mouth opening was found after emergency procedure of releasing the labial commissures after infiltration of 2% lidocaine with adrenaline as the local anesthetic agent (Mishra et al., 2022).

Retrospective study of 833 procedures conducted by Karlsen et al. (2023) reported a 3.5% incidence of failed attempts at AFOI. In nine cases, failures led to loss of airway control with desaturation and hypoventilation. The most common cause of failure was tube dislocation after induction of general anesthesia. Other significant causes included inability to pass the tube, pharyngeal reflexes, patient distress, and airway bleeding. Bleeding complicates bronchoscopy by obscuring the view and absorbing light. The higher failure rate in the study was attributed to low procedural volume per anesthesiologist, a heterogeneous patient population, and the exclusive use of AFOI for patients with expected difficult intubations (Karlsen et al., 2023). In this case, AFOI was conducted successfully with non-kinking ETT internal diameter of 7.0 via left nostril, the patient remained calm, awake cooperative, and have blunted airway reflexes, due to adequate topicalization with lidocaine and administration of dexmedetomidine titrated infusion that offer offers anxiolytic, amnestic, analgesic, and antisialagogue properties, and preserved respiratory function.

CONCLUSION

The research results indicate that various tests can predict difficult airways, and these cases can be managed according to ASA guidelines. The AFOI technique, which includes premedication, local anesthesia, and sedation, has a high success rate and low risk of complications. Proper topical anesthesia and dexmedetomidine infusion are effective in blunting airway reflexes and maintaining hemodynamic stability. In this case, AFOI was successfully performed through the left nostril with the patient remaining calm, awake, and cooperative.

ACKNOWLEDGEMENT

The author expresses deep appreciation to everyone who contributed to the completion of this research, facilitating its timely conclusion. The hope is that the outcomes of this study will bring benefits to society and enhance the existing body of knowledge. Thank you.

REFERENCES

Agarwal, R., Dhar, M., & Banerjee, A. (2021). Airway Management in Pediatric Facial Burn Contracture: Safety, Innovation, and Expertise. *Journal of Medical Sciences*, *41*(4), 211. https://doi.org/10.4103/jmedsci.jmedsci_173_20

Ahmad, I., El-Boghdadly, K., Bhagrath, R., Hodzovic, I., McNarry, A. F., Mir, F., O'Sullivan, E. P., Patel, A., Stacey, M., & Vaughan, D. (2020). Difficult Airway Society guidelines for awake tracheal intubation (ATI) in adults. *Anaesthesia*, *75*(4), 509–528. https://doi.org/10.1111/anae.14904

Apfelbaum, J. L., Hagberg, C. A., Connis, R. T., Abdelmalak, B. B., Agarkar, M., Dutton, R. P., Fiadjoe, J. E., Greif, R., Klock, P. A., Mercier, D., Myatra, S. N., O'Sullivan, E. P., Rosenblatt, W. H., Sorbello, M., & Tung, A. (2022). 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. *Anesthesiology*, *136*(1), 31–81. https://doi.org/10.1097/ALN.0000000000004002

Bhatnagar, A., & Singh, A. (2020). The postburn severe flexion contracture neck correction with split-thickness skin graft: Our experience. *Indian Journal of Burns*, *28*(1), 36. https://doi.org/10.4103/ijb.ijb_12_20

Brown, C. A., Sakles, J. C., Mick, N. W., Mosier, J. M., & Braude, D. A. (2022). *The Walls Manual of Emergency Airway Management*. Lippincott Williams & Wilkins.

Cabrini, L., Baiardo Redaelli, M., Ball, L., Filippini, M., Fominskiy, E., Pintaudi, M., Putzu, A., Votta, C. D., Sorbello, M., Antonelli, M., Landoni, G., Pelosi, P., & Zangrillo, A. (2019). Awake Fiberoptic Intubation Protocols in the Operating Room for Anticipated Difficult Airway: A Systematic Review and Meta-analysis of Randomized Controlled Trials. *Anesthesia & Analgesia*, *128*(5), 971. https://doi.org/10.1213/ANE.0000000000004087

Dhua, S., & Raheel, S. (2022). Improvement in functional and aesthetic outcome in postburn contracture of neck following split skin grafting using goniometer. *Indian Journal of Burns*, *30*(1), 24. https://doi.org/10.4103/ijb.ijb_12_22

Groombridge, C. J., Maini, A., Johnny, C., McCreary, D., Kim, Y., Smit, D. V., & Fitzgerald, M. (2022). Randomised controlled trial in cadavers investigating methods for intubation via a supraglottic airway device: Comparison of flexible airway scope guided versus a retrograde technique. *Emergency Medicine Australasia*, *34*(3), 411–416. https://doi.org/10.1111/1742-6723.13908

Jain, M., Kiran, S., Bhardwaj, M., Aeron, N., & Singh, A. K. (2024). Effect of supine and upright position on Mallampati grading in predicting difficult laryngoscopy and intubation: A prospective, observational study. *Bali Journal of Anesthesiology*, *8*(1), 40. https://doi.org/10.4103/bjoa.bjoa_258_23

Jung, H. (2023). A comprehensive review of difficult airway management strategies for patient safety. *Anesthesia and Pain Medicine*, *18*(4), 331–339. https://doi.org/10.17085/apm.23123

Kamal, K., Rani, D., Ahlawat, G., & Bansal, T. (2023). Prediction of Difficult Endotracheal Intubation by Different Bedside Tests: An Observational Study. *Bali Journal of Anesthesiology*, *7*(1), 8. https://doi.org/10.4103/bjoa.bjoa_228_22

Karlsen, K. A. H., Gisvold, S. E., Nordseth, T., & Fasting, S. (2023). Incidence, causes, and management of failed awake fibreoptic intubation—A retrospective study of 833 procedures. *Acta Anaesthesiologica Scandinavica*, *67*(10), 1341–1347. https://doi.org/10.1111/aas.14313

Mishra, D., Chakole, V., & Dev, P. (2022). Difficult Airway Management in a Patient With Post-burn Contracture Neck. *Cureus*. https://doi.org/10.7759/cureus.30011

Mittal, B. M., McQuitty, R. A., Talon, M., & McQuitty, A. L. (2024). Airway Management for Acute and Reconstructive Burns: Our 30-year Experience. *Seminars in Plastic Surgery*. https://doi.org/10.1055/s-0044-1786008

Sabapathy, S. R., Shanmugakrishnan, R. R., Ramkumar, S., Muthukumar, V., Senthilkumaran, M., & Bharathi, R. R. (2022). Postburn Reconstruction of the Face and Neck. *Plastic and Reconstructive Surgery*, *150*(6), 1326e. https://doi.org/10.1097/PRS.0000000000009690

Sahoo, M., & Vig, S. (2023). Managing difficult airway in a post burn neck contracture: A case report. *Journal of Clinical Images and Medical Case Reports*, *4*(10). https://doi.org/10.52768/2766-7820/2669

Saoraya, J., Vongkulbhisal, K., Kijpaisalratana, N., Lumlertgul, S., Musikatavorn, K., & Komindr, A. (2021). Difficult airway predictors were associated with decreased use of neuromuscular blocking agents in emergency airway management: A retrospective cohort study in Thailand. *BMC Emergency Medicine*, *21*(1), 37. https://doi.org/10.1186/s12873-021-00434-2

Simon, L. V., & Torp, K. D. (2024). Laryngeal Mask Airway. In *StatPearls*. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK482184/

Trambadia, D. N., Yadav, P., & A, S. (2023). Preoperative Assessment to Predict Difficult Airway Using Multiple Screening Tests. *Cureus*, *15*(10), e46868. https://doi.org/10.7759/cureus.46868

Verma, A. K., Verma, S., Barik, A. K., Kanaujia, V., & Arya, S. (2021). Intubating conditions and hemodynamic changes during awake fiberoptic intubation using fentanyl with ketamine versus dexmedetomidine for anticipated difficult airway: A randomized clinical trial. *Brazilian Journal of Anesthesiology (English Edition)*, *71*(3), 259–264. https://doi.org/10.1016/j.bjane.2021.01.005

Wang, Z., Yang, Y., Chen, Y., Yi, B., Lu, K., & Chen, B. (2021). Fiberoptic-guided tracheal intubation under precise anesthesia and topicalization with spontaneous respiration preservation for an uncooperative patient with severe postburn mentosternal contracture. *Clinical Case Reports*, *9*(12), e05208. https://doi.org/10.1002/ccr3.5208