

Perioperative Anaesthetic Management of Ludwig's Angina with Awake Fiberoptic Intubation and Ultrasound Guided Cervical Plexus Block: A Case Report

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ABSTRACT

Ludwig's Angina (LA) is an acute infection associated with the deep cervical region that can rapidly lead to airway obstruction. Unique problems arise in airway management due to trismus, an elevated floor of the mouth, abnormal airway anatomy, and sudden airway obstruction at the time of induction of anaesthesia when such infections are present. This report describes the perioperative management of a 46-year-old male who presented with progressively worsening submandibular swelling, dysphagia, and restricted mouth opening due to an odontogenic infection. He was scheduled for an urgent incision and drainage of a submandibular abscess. Given the anticipated difficult airway, the patient was intubated awake using a nasal fiberoptic technique while receiving dexmedetomidine sedation and nebulised lignocaine for airway topical anaesthesia, with spontaneous ventilation maintained throughout the procedure. Following successful airway management, he was subsequently given General Anaesthesia (GA) and a Superficial Cervical Plexus Block (SCPB) (performed by ultrasound guidance) to provide perioperative analgesia. Upon completion of the surgical procedure, the patient required elective postoperative ventilatory support due to airway swelling and was subsequently extubated with relative ease after demonstrating clinical stability. This case illustrates the significance of complete airway planning, maintenance of spontaneous ventilation during airway procedures, and the benefits of utilising several anaesthetic techniques to ensure the safe provision of required perioperative anaesthetic care for patients with LA.

Keywords: Dexmedetomidine, Difficult airway, Lignocaine nebulisation, Regional anaesthesia, Trismus

CASE REPORT

A 46-year-old male, with a Body Mass Index (BMI) of 29.1, presented to the emergency department with a 4-day history of rapidly worsening bilateral submandibular swelling that has been painful, as well as dysphagia (difficulty swallowing), fever, excessive salivation, and progressively worsening trismus. Five days earlier, he reported pain in the lower left molar, followed by the development of bilateral submandibular swelling over the subsequent three days. He has had progressively worse trouble swallowing solids as well as liquids for the last 24 hours; he also noticed a change in his speech, trouble handling oral secretions, and a feeling of enlargement of his tongue. Bedside pulmonary function assessment revealed a single breath count of 12, breath-holding time of 14 seconds, and an inability to tolerate the supine position due to airway discomfort.

He had a history of diabetes mellitus type II for the past eight years and had been taking metformin 500 mg twice a day and glimepiride 2 mg daily. He also had a diagnosis of hypertension for the prior five years, managed with amlodipine 5 mg once daily. He had no surgical history. He had been using chewable tobacco for about 15 years, and he occasionally drank alcohol. There were no known drug allergies. Amlodipine was withheld on the day of surgery, and metformin was discontinued during the perioperative period with blood glucose managed using sliding-scale insulin.

He was oriented, cooperative, and alert at the time of examination; however, he was highly anxious due to neck pain and swelling. On examination, the patient was febrile with a temperature of 38.4°C, tachycardic with a heart rate of 112 beats/min, blood pressure of 142/86 mmHg, and respiratory rate of 22 breaths/min. The peripheral oxygen saturation while breathing room air was 97%. At the time of neck examination, diffuse, tense oedema was noted in the submandibular and submental areas, in addition to significant erythema, induration, and severe tenderness. Elevation of the

floor of the oral cavity with superior displacement of his tongue was observed; he was unable to fully open his mouth (interincisor distance approximately 1.2 cm). Due to trismus, Mallampati grading could not be completed. Neck movement was limited due to the pain and swelling. He preferred a semi-sitting position.

An investigation of the patient's laboratory results showed leucocytosis, with a total leukocyte count of 17,800 cells/mm³, of which neutrophils accounted for 86%, with a raised C-reactive protein level of 56 mg/L. He had normal serum electrolytes, renal function, and liver function tests. On electrocardiography, the patient had a normal sinus rhythm. Screening 2D echocardiography revealed no regional wall motion abnormality and a normal ejection fraction (60%). Contrast-enhanced computed tomography of the neck demonstrated bilateral diffuse cellulitis of the submandibular and sublingual spaces, as well as collections of fluid suggestive of abscess formation. The patient had upper airway narrowing due to surrounding soft-tissue oedema and exhibited classic signs of LA.

He required urgent incision and drainage of the abscess in the submandibular space. He was classified under the American Society of Anaesthesiologists' (ASA) physical status III-E. Due to the patient's distorted airway anatomy, trismus, and potential for airway obstruction after induction of GA, an AFOI with spontaneous ventilation was planned. The patient was nil per os for eight hours for solids and liquids at the time of the surgery. The difficult airway cart, containing a video laryngoscope, bougie, supraglottic airway devices, and emergency cricothyroidotomy equipment, was kept readily available. An otolaryngologist was kept close by in case the patient required emergency tracheostomy. Written informed consent was obtained for the procedure and anaesthesia.

The patient was positioned in a semi-recumbent posture upon entering the operating room, and continuous ASA monitors were attached to monitor the patient's vital signs throughout the

procedure. The patient had a baseline HR of 110 beats per minute, BP of 138/82 mmHg, and oxygen saturation of 98% on room air. An 18-gauge intravenous catheter was placed, and lactated Ringer's solution was administered at 100 mL/hour. The patient was given topical anaesthesia with nebulised 4% lignocaine (10mL) delivered via an oxygen-driven nebuliser over approximately 15 minutes. The patient also received topical nasal anaesthetic drops of xylometazoline 0.1% into each nostril prior to instrumenting, to reduce the extent of mucosal congestion. The patient was administered dexmedetomidine intravenously as a means to provide for sedation at a total dose of 1 µg/kg in a bolus over the course of 10 minutes, then continued as an infusion at a volume rate of 0.5 µg/kg/hr throughout the duration of the surgical procedure. The patient was calm and cooperative, maintaining spontaneous ventilation. Supplementary oxygen was delivered via nasal cannula at 4 L/min, and the patient's oxygen saturation remained between 98% and 100% at all times.

AFOI was used to facilitate nasal intubation. Oedema of the oropharyngeal tissue, an occlusion of the supraglottic region, and the glottic opening were visualised. A cuffed endotracheal tube of 7.0 mm internal diameter was railroaded into the trachea via the bronchoscope. The tube was correctly positioned using capnography and auscultation. Following this, the induction of GA was performed using intravenous propofol (2mg/kg) and fentanyl (2µg/kg), vecuronium (8 mg). Anaesthesia maintenance was achieved with a combination of oxygen and air and sevoflurane at an end-tidal vapor concentration of 1-1.5%.

Following this, a Superficial Cervical Plexus Block (SCPB) was performed bilaterally for the provision of perioperative analgesia, with 10 mL of 0.25% bupivacaine into the fascial plane at the depth of the investing fascia using a high-frequency linear ultrasound probe placed posteriorly adjacent to the posterior border of the sternocleidomastoid muscle at the level of the C4 vertebra.

The surgical team performed incision and drainage of the submandibular abscess, evacuating approximately 30 mL of thick purulent fluid and thoroughly irrigating infected cavities. The procedure lasted 60 minutes. HR (80-95 bpm) and BP (110/70 mmHg-130/80 mmHg), oxygen saturation (99%) were stable during the procedure. At the end of the case, the neuromuscular blockade was reversed with i.v. neostigmine 2.5mg and glycopyrrolate 0.5mg. Neuromuscular blockade was monitored intraoperatively using Train-Of-Four (TOF) monitoring reversal was administered after reappearance of TOF responses. Due to significant airway oedema and ongoing infection, the patient was electively ventilated.

The patient remained haemodynamically stable in the Intensive Care Unit (ICU). Extended use of IV piperacillin-tazobactam 4.5g i.v. thrice daily continued in the ICU. The patient had a noticeable reduction in neck swelling and airway oedema 24 hours postoperatively. A cuff leak test was done, and it was satisfactory. The patient was extubated without incident and had an oxygen saturation >98% on oxygen supplement. The patient had an uncomplicated postoperative course and was discharged on the fifth postoperative day after sufficient clinical improvement. During his 1-month follow-up appointment, the patient was symptom-free, with complete resolution of his neck swelling and infection, and a good, intact surgical site with no complications.

DISCUSSION

The LA can rapidly spread through the submandibular, sublingual, and submental fascial spaces. LA poses a potential threat to the airway's life-giving function. The source of the infection is often odontogenic. The odontogenic infection spreads through the connective tissue planes of the neck, producing considerable edema, thickening, and elevation of the floor of the mouth. As the swelling progresses, it displaces the tongue posteriorly and narrows the upper airway, making safe airway management a paramount

concern for the anaesthetist. Because airway management is the most significant complication feared with LA, anaesthetic management focuses primarily on early identification of the problem and establishing a safe airway [1,2].

Several anatomical and physiological characteristics complicate airway management in LA. Severe trismus due to an inflammatory reaction in the masticatory muscles frequently results in limited mouth opening, making traditional laryngoscopy or direct visualisation of the larynx impossible in most cases. The elevation of the tongue, edema at the floor of the mouth, and distortion of the airway landmarks further limit visibility of the laryngeal structures. Swelling of the submandibular region may further limit neck range of motion, thereby making it difficult to manage mask ventilation [1,3].

A significant concern with inducing GA is the risk of sudden airway collapse. The use of sedatives or neuromuscular blocking agents results in loss of pharyngeal muscle tone and may cause complete obstruction of an already compromised airway. Prior to inducing anaesthesia, adequate planning and preparation should be implemented in anticipation of a possible airway failure. Several methods are available for the management of the airway, like AFOI, tracheostomy, blind nasotracheal intubation, and video laryngoscopy; however, AFOI has been reported as one of the safest methods of managing anticipated difficult airways since it allows for visualisation of airway structures while also allowing for maintenance of spontaneous ventilation and airway reflex activity [4,5]. In this case, the patient had the classical indicators of a difficult airway (trismus, tongue elevation, submandibular swelling, and discomfort in the supine position). The decision was made to use AFOI for airway management.

Sujatha M et al. documented an airway situation very similar to this case, in which the patient had difficulty being supine due to significant trismus associated with LA use and considerable neck swelling. AFOI was done with the patient laterally with the assistance of lignocaine sprays utilising a "spray-as-you-go" technique. Although the methods of patient positioning and topicalisation differed, both reports stressed the importance of maintaining spontaneous ventilation and intact airway reflexes during intubation [6].

Sedation administered during AFOI must be titrated in such a way that co-operation is maintained without being sedated to the point of respiratory depression. Dexmedetomidine was used in this case to induce cooperative sedation with a minimal effect on respiratory depression [7]. The report of Sujatha M et al., touts minimal sedation achieved by administering fentanyl and glycopyrrolate, again stressing the importance of avoiding sedation to excess when dealing with an unsecured airway [6].

Another approach for managing a patient exhibiting LA and having a mouth opening of approximately 10 mm has been reported in the report of Rahman T et al., where a patient who was pregnant, with the risk of abscess rupture and aspiration, was treated with the use of AFOI. Surgical decompression of the infected area with a bilateral SCPB and mandibular nerve block was performed. Drainage of the infected spaces resulted in rapid relief of the airway obstruction. There was no need to use any airway instrumentation. This demonstrates that regional anaesthesia is an acceptable alternative in select cases [8].

Gupta AK et al., reported a case of 11-year-old male with LA in which abscess drainage was done under SCPB and mandibular nerve block [9]. This case utilised an SCPB as a supplemental analgesic in conjunction with GA. The case described by Bagle A et al., in which AFOI was utilised in a patient with significant predictors of difficulty. The patient experienced airway compromise shortly following extubation, requiring an emergency tracheostomy. This emphasises the importance of developing and implementing a thoughtful extubation plan and maintaining the necessary resources for rapid airway intervention should it be needed [10].

Author	Case description	Anaesthetic management	Takeaway
Present case	A 46-year-old male (BMI 29.1) with DM II and hypertension presented with rapidly progressive bilateral submandibular swelling, fever, dysphagia, drooling, trismus, and muffled speech following dental infection. Severe trismus (~1.2 cm), tongue elevation, inability to lie supine, and CECT-confirmed LA with airway narrowing. ASA III-E.	AFOI in semi-recumbent position under topical airway anaesthesia with dexmedetomidine sedation, maintaining spontaneous ventilation. GA induced after airway securement. SCPB used for perioperative analgesia. Neuromuscular blockade was monitored using TOF monitoring; reversal was administered after reappearance of TOF responses. ICU care with delayed extubation after cuff leak test.	AFOI with spontaneous ventilation is safest in LA; TOF-guided paralysis and delayed extubation in the ICU reduce airway risk.
Gupta AK et al., 2009 (India) [9]	11-year-old male with LA due to dental infection presenting with fever, tachycardia, leukocytosis, severe submandibular swelling, dysphagia, and trismus. Saturation was 96% on room air with significant airway limitation.	SCPB with an inferior alveolar nerve block and conscious sedation (midazolam) enabled incision and drainage with dental extraction, avoiding GA. Emergency tracheostomy backup was prepared.	SCPB-based regional techniques can avoid GA in selected LA cases and facilitate safe surgical drainage.
Sujatha M et al., 2015 (India) [6]	35-year-old male with progressive neck and facial swelling following dental infection, with trismus, inability to lie supine, asthma, hypertension, and uncontrolled diabetes. Anticipated a difficult airway with hypoxemia.	AFOI in the lateral position under topical lignocaine and sedation, followed by GA. Postoperative elective ventilation in the ICU with delayed extubation.	AFOI in modified positions is effective in severe LA; elective ventilation improves safety in difficult airway cases.
Dsouza RJ et al., 2021 (India) [5]	A 41-year-old female developed LA after molar extraction with fever, dysphagia, trismus, and bilateral submandibular swelling but without respiratory distress or stridor. Hemodynamically stable with normal labs. Managed in a resource-limited setting.	Conservative management with i.v. antibiotics and close observation. No immediate airway intervention; spontaneous intraoral drainage occurred with clinical improvement and recovery without surgery.	Selected stable LA patients without airway compromise may be managed conservatively with careful monitoring in resource-limited settings.
Kovalev V, 2020 (USA) [3]	A 57-year-old male with multiple comorbidities presented after repeated dental pain visits and was later diagnosed with LA with impending airway obstruction. The condition progressed to severe infection requiring urgent surgical airway management and dental extraction. The hospital course was prolonged with complications, but eventual recovery.	Emergency surgical airway management with urgent debridement and extraction of infected teeth due to impending airway compromise. Emphasis on rapid escalation of care and multidisciplinary management.	LA can rapidly progress to life-threatening airway obstruction; early recognition, timely airway control, and aggressive surgical management are critical to reduce morbidity and complications.

[Table/Fig-1]: Anaesthetic management of LA in various case reports.

While using regional anaesthesia for the management of deep neck infections perioperatively is a well-accepted practice, the use of ultrasound-guided SCPB was used to decrease opioid requirements for pain control while securing the airway, after placement of an endotracheal tube for anaesthetic induction, during surgical debridement. As a result, both approaches support the assertion of AFOI's ongoing superiority in patients with suspected difficult airways, as drainage of abscesses from LA with regional anaesthesia, such as ultrasound-guided SCPB, may provide adjunctive use or, at times of clinical need, an alternative [6,8,9].

A summary of relevant published case reports on LA and their anaesthetic implications is presented in [Table/Fig-1].

CONCLUSION(S)

To successfully manage anaesthesia in a patient with LA, there must be an extensive evaluation of the patient prior to surgery, careful airway planning, and alternative airway management available if needed. Airway nerve blocks were avoided because distorted anatomy, infection, oedema, and patient discomfort increased technical difficulty and risk of complications. AFOI with adequate topical anaesthesia and the ability to maintain spontaneous ventilatory efforts continues to provide a safe and reliable technique for airway management in patients with an expected difficult airway due to deep neck infection. Careful intraoperative

monitoring, appropriate use of regional analgesia, and meticulous postoperative airway management are essential components of comprehensive perioperative care in patients undergoing these complex procedures.

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