

Management of Ludwig's angina with small neck incisions: 18 years experience

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OBJECTIVE: To review Ludwig's angina medical and surgical approach with small incisions.

STUDY DESIGN: Retrospective, open, noncomparative, longitudinal.

METHODS: All patients with Ludwig's angina who received medical, metabolic, airway management, and surgical treatment from January 1, 1983 to December 31, 2000.

STUDIED PARAMETERS: Antibiotic treatment, surgical treatment, hospitalization time, associated diseases, etiologic factors, recuperation time.

RESULTS: Age range was 18 to 87 years, with a female-to-male ratio of 1.1:1 (68 females, 53 males). Thirty patients belonged to middle or high socioeconomic status. The primary site of infection was odontogenic in 107 of the patients. All the patients were managed with surgical drainage made within the first 12 hours after hospital admission. The most common antibiotic treatments were the combination of clindamycin with crystalline penicillin G. The hospital stay for more than half of patients was 6 days or less. In 62 patients we found extension into the parapharyngeal space and in 32 cases we found retropharyngeal extension of the Ludwig's angina. Forty-six patients had or were diagnosed as having diabetes mellitus. Tracheotomy was required in 34 patients. The airway of the rest of patients was controlled with nasotracheal intubation. Only 33 patients had major complications, such as mediastinitis, sepsis, or death.

CONCLUSIONS: Drainage using small incisions is a safe and effective method as part of treatment of Ludwig's angina. (Otolaryngol Head Neck Surg 2004;130:712-7.)

In 1836 Wilhelm Frederick von Ludwig described a disseminated infection through the posterior border of the mylohyoid muscle to the submaxillary, sublingual, and submental spaces that together form the submandibular space. The infection usually starts in either the submaxillary or the sublingual spaces and then disseminates to all of the submandibular space; it begins as a cellulites, then turns into fasciitis, and finally becomes a true abscess.¹

Anatomic boundaries of the submental space are both anterior belly of the digastric muscles; the roof is formed by the mylohyoid muscle and the floor the mouth; its anterior border is the symphysis of the mandible and in its posterior border is the hyoid bone. The submaxillary space is separated from the sublingual space by the mylohyoid muscle; medially, the hyoglossus and styloglossus muscles; and laterally, the body of the mandible. The lateral border is formed by the skin, superficial fascia, platysma, and the superficial layer of the deep cervical fascia. The anterior and posterior belly of the digastric muscle forms its inferior border. Its anterior portion freely communicates with the submental space and its posterior portion with the sublingual and the deep neck spaces. The sublingual space has as anterior and lateral boundaries the mandible, superior with the floor of the mouth and tongue; inferior to this space lies the mylohyoid muscle. Posterior to this space is the hyoid bone and medially the genioglossus, styloglossus, and geniohyoid muscles. This space communicates freely on its anterior portion with the submental space and posteriorly with the submaxillary space.^{1,2}

The etiology for most series is odontogenic or periodontal disease in 75% to 90% of cases. The mylohyoid line and the mylohyoid muscle play an important part in the pathophysiology of the disease; infections of the second or third molar affect the beginning of the submaxillary space.^{2,3}

In patients with Ludwig's angina the treatment is directed in three ways: airway safety, antibiotic

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treatment, and surgical drainage. Metabolic control and fluid replacement are important adjuncts.

The first consideration in a patient with Ludwig's angina is airway control. All patients with this pathological entity require attention to the airway and a third of them require immediate fiber-optic nasotracheal intubation or tracheotomy with topical anesthesia. The blind nasotracheal or orotracheal intubations are not recommended because of the danger of total airway obstruction. The edema of the tongue and mouth and trismus are the most common obstacles for an oral intubation. Tracheotomy must be done only if it is not possible to intubate with an unstable airway. The intubation must be done without narcotics because of the risk of losing the airway due to respiratory depression.^{1,2}

After the airway is secure, cultures should be obtained before parenteral antibiotics are applied. Hospitalization is always indicated, with hospital stays averaging over 11 days.²

Antimicrobial regimens in the treatment of Ludwig's angina have been recommended and should cover the usually polymicrobial (gram-positive, gram-negative, aerobic, and anaerobic) etiology. Most authors recommend the combination of crystalline G penicillin with an adult dose of 4 to 30 million International Units (IU) per day via intravenous (IV) route, divided in doses every 4 or 6 hours or in continuous infusion, combined with metronidazol 1 g as a loading dose followed by 500 mg every 6 hours. Others recommend metronidazol 1 g every 12 hours IV. Other alternatives are also described: clindamycin 450-900 mg IV every 8 hours, or ticarcillin clavulanate 3.1 g every 6 hours IV, or ampicillin sulbactam 3 g every 6 hours IV, or piperacillin tazobactam 3.375 g divided every 6 hours IV.³⁻⁵

In children, penicillin G dose is 100,000-400,000 IU/day divided in doses every 4 to 6 hours or in continuous infusion with a maximal dose of 24 million IU/day. When using penicillin the dose must be adjusted to renal function. Metronidazol dose in children is 30 mg/kg/day divided in doses every 6 hours with a maximal dose of 4 mg/day with a loading dose of 15 mg/kg. The intravenous infusion velocity must be slow and used with caution in patients with hepatic or renal impairment.⁶ Fairbanks recommends ampicillin

sulbactam 3 g/day every 6 hours IV or clindamycin 450-900 mg IV every 8 hours with a third-generation cephalosporin, such as ceftazidime, in doses of 2 to 6 grams per day every 8 to 12 hours IV this because of bacterial resistance agents.^{6,7}

Surgical drainage is indicated for an abscess for patients with impending complications and if there has been no improvement after 24 to 48 hours of parenteral antibiotics. Needle aspiration is an accepted method for obtaining material for culture. Single aspiration of small abscesses or placement of indwelling catheters to allow repeat aspirations of larger abscesses may offer an alternative to surgical incision and drainage. The exact mechanism by which the surgical drainage improves the resolution of odontogenic infections remains unknown. It is believed, however, that the improvement of local perfusion, the decrease of hydrostatic pressure, and the introduction of superficial mucosal flora are factors that help to decrease the spread of the invading pathogens.² In our department, the submandibular space is drained through an incision of 1.5 cm to 2.0 cm in extension, 2 cm below the inferior border of the mandible. Once the incision is made a dissection in the subplatysmal space of the submaxillar and sublingual space is done; for the submental space a similar incision and dissection is done below the symphysis of the mandible; and posteriorly all the spaces are joined together by dissection. The literature we reviewed revealed that the incisions recommended were different, with wide-open incisions with fasciotomies and radical exposure. In some centers the surgical drainage is not recommended for children younger than 10 years old. The early extraction of the odontogenic site of infection has been proven to decrease the recuperation time.⁸⁻¹²

MATERIAL AND METHODS

This study was retrospective, descriptive, observational, and longitudinal, in which the total clinical register of patients with the diagnosis of Ludwig's angina in the Otolaryngology Division of Dr. Manuel Gea González General Hospital from January 1, 1983 to December 31, 2000 were included and reviewed.

Table 1. Patients' age distribution

Age range	Number of patients
Under 20 years	2
21-30	14
31-40	26
41-50	25
51-60	30
61-70	12
Over 70 years	12

RESULTS

Between January 1, 1983 and December 31, 2000, 121 patients with a diagnosis of Ludwig's angina were treated. The ages ranged from 15 to 87 years with a median age of 48 years. A great number of patients were older, in the 51-to-60-year range (Table 1). The female was the gender most affected, with 68 (56%) of patients vs 53 (44%) male patients, giving a ratio of 1.1:1. Ninety-one of the patients belong to a low socioeconomic level, 26 patients belong to a medium socioeconomic level, and only 4 patients belong to a high socioeconomic level, based upon the hospital social work classification.

The odontogenic origin of infection was found in 107 (89%) patients; in 1 (0.8%), lymphadenitis was identified as the primary source of infection; and in the other 13 (10.2%) patients the source of infection was impossible to identify. A total of 121 (100%) patients received surgical drainage within the first 12 hours of hospital admission.

All patients had at least an antero-posterior and lateral simple radiograph of the neck to evaluate the presence of extension to the parapharyngeal and retropharyngeal spaces, and also postero-anterior and oblique chest radiograph to evaluate mediastinitis (Fig 1).

The surgical drainage consisted of three incisions: two incisions, of 1.5 to 2 cm of extension, 2 cm below the border of the mandible bilaterally, to decompress the submaxillary and sublingual spaces; and a similar incision below the symphysis of the mandible, through which the submental space was drained. All spaces were connected (Fig 2). Sixty-two (51%) patients had infections extending into the parapharyngeal space; in this case, besides the standard treatment described, an incision was made 2 cm

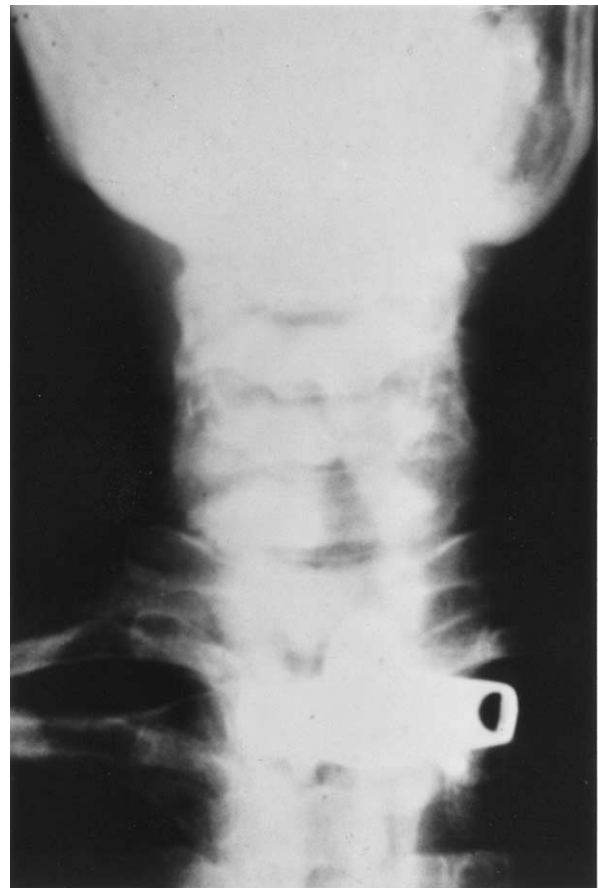


Fig 1. Antero-Posterior plain x-ray of the neck of a patient with Ludwig's Angina shows parapharyngeal extension. Notice the obstruction of the airway managed with a tracheostomy.

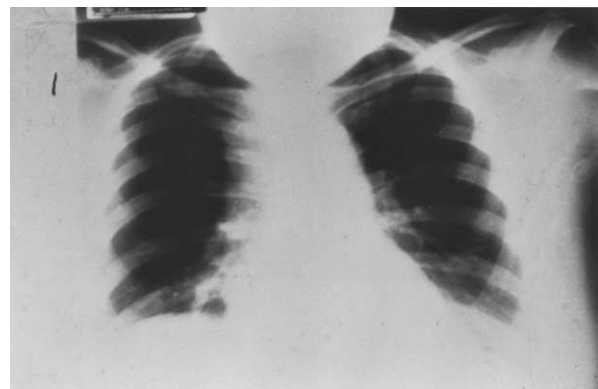


Fig 2. Postero-anterior chest radiograph of a patient with Ludwig's angina with parapharyngeal and retropharyngeal extension and mediastinitis as a complication.

anterior to the sternocleidomastoid muscle and 2 cm below the border of the mandible, making dissection in the anteroposterior direction until



Fig 3. Photograph showing the surgical drainage of a Ludwig's angina with small incisions connected in the subplatysmal plane.

purulent material or gas was found, connecting with the other dissections. Thirty-two of the 62 parapharyngeal space extension patients (26% of the total) presented a retropharyngeal abscess (Fig 3), which was drained through an intraoral and transmucosal incision.

Airway management was fundamental in patients with Ludwig's angina. Orotracheal intubation was generally impossible because of the trismus and the swollen floor of the mouth, which makes a posterior deviation of the upper airway. The major proportion of cases were managed with fiber-optic nasotracheal intubation, which was well tolerated for all patients in the 3 to 4 days while the edema resolved. When the intubation was impossible because of the local or urgent conditions, tracheotomy was performed in 34 (28%) patients. Forty-six (38%) patients had diabetes mellitus as an associated condition, of which 11 cases were diagnosed for the first time because of these infections.

The most common antibiotic treatment was the combination of crystalline G penicillin 4 million IU IV every 4 hours with clindamycin 600 mg IV every 8 hours in 77 (63.6%) patients. The second most frequent antibiotic combination was penicillin-clindamycin and amikacin in 12 (9.9%) patients. The third most common antibiotic combination was ceftazidime-clindamycin in 10 (8.2%) patients. The other antibiotic combinations used are shown in Table 2. Two patients didn't respond effectively to the first antibiotic combination of penicillin G with clindamycin with leucocytosis and purulent secretion, so

Table 2. Antibiotic scheme used

Antibiotic treatment	Number of patients
Penicillin - Clindamycin	77
Penicillin - Clindamycin - Amikacin	12
Penicillin - Metronidazol	10
Ceftazidine - Clindamycin	10
Ceftazidine - Clindamycin - Amikacin	3
Ceftriaxon - Clindamycin	5
Ciproxin - Clindamycin	3
Teicoplanin - Ciproxin - Clindamycin	1

the treatment was changed to ciprofloxacin-clindamycin with good response. In another patient the initial treatment was modified to metronidazol-penicillin because of a hypersensitive reaction to clindamycin.

The minimal in-hospital stay was 2 days and the maximal was 32 days, with a mean hospital stay of 5 days. However, more than a half of patients 51.8%, had a hospital stay of 6 days or less. All patients were with oral food tolerance; without airway problems; and with glucose, white cells, and associated factors controlled (diabetes and tooth infection).

Tracheotomy was required in 34 (28%) patients. In one patient a cricotiroidectomy was required. In these patients the fiber-optic nasotracheal intubation failed. A total of 88 (72.72%) patients didn't present any complications, 26 (21.48%) had septicemia, 15 (12.3%) had mediastinitis, and 11 (9.09%) died because of the metabolic complications. Of the 11 patients who died, 9 (81.81%) were diabetics of new diagnosis, and the mortality among diabetics raised to 19%.

All patients were cultured; however, only 20% grew pathogens. The most frequent agents were *Enterobacter aerogenes* and *Staphylococcus-negative coagulase*. Our hospital center does not have anaerobic cultures.

DISCUSSION

In our study the most frequent age group was between 51 and 60 years, with female patients slightly more frequent. This does not correspond with the reviewed current literature, which shows a peak incidence between 20 and 40 years and a male preponderance.^{2,5,12}

In this study the primary origins of infection were similar to those found in the literature, with



Fig 4. Lateral radiograph of the neck of a patient with Ludwig's angina shows retropharyngeal extension.

an odontogenic focus as the most frequent, followed by unknown origin. Diabetes mellitus was found as the most commonly associated pathology, raising the probability of complications and mortality.^{2,5,11}

The combination of antibiotics most frequently used was clindamycin and penicillin, which is recommended in the current world literature.^{3-5,7}

Patients with systemic conditions were not appropriate to make conclusions in the outcome antibiotic treatment. Hospital stays, which between 1982 and 1993 were 10 to 15 days, have decreased in the last years. In the world literature the mean hospital stay is 11 days. In these last 5 years of experience half of patients had an intrahospital stay of less than 6 days. This could be explained by the size of incisions, which were smaller than those recommended by the publications, the sur-

gical drainage within the first 12 hours in 100% of patients, the early antibiotic treatment, and the metabolic control taken by the internal medicine division.^{2,11,12}

In patients with other associated factors such as diabetes mellitus, retropharyngeal and parapharyngeal abscess, and tracheotomy, the hospital stay was longer, with a median of 9 days and a mean of 7.2 days.

The absence of culture growth could be explained by the lack of special techniques of anaerobic culture or previous administration of antibiotics.

For all patients who required tracheotomy or cricotiroidectomy because of acute respiratory insufficiency or the impossibility of nasotracheal intubation, we kept the tube in 3 days until the surgical drainage, with the decrease in edema and absence of airway impairment, occurred.^{1,2} Complications such as mediastinitis, septic shock, or death correspond in our study with the publications, with no increase with the use of small incisions.¹²

CONCLUSION

Surgical drainage within the first hours with small incisions with subplatysmal communication, early metabolic control, early extraction of the odontogenic origin, proper airway management, and antibiotic treatment decreases the hospital stay and the recuperation period, without an increase in the number of complications (Fig 4).

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