

# Efficacy of Corrugated Rubber and Plastic Tube Drains in the Management of Ludwig's Angina- a Retrospective Comparative Study

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## Abstract

The aim of this study is to determine the effectiveness of corrugated rubber and tube drains in the management of Ludwig's angina patients. This retrospective comparative study was designed for patients with Ludwig's angina that presented to the Department of Oral and Maxillofacial Surgery, University of Benin teaching hospital, Nigeria between June 2008 and July 2018. Data collected from the case notes of the patients were age, gender, type of surgical drain, airway compromise, length of hospital stay, and retreatment. Descriptive and inferential statistics were performed with SPSS Version 17 (SPSS Inc, Chicago, USA). All tests were 2-sided and P-Value less than 0.05 was considered statistically significant. Of the 55 patients studied, 32 (57.3%) had plastic tube drains while 23 (42.7%) had corrugated rubber drains. Their ages ranged from 19-72 years with a mean  $\pm$  SD of  $42.1 \pm 13.7$  years. There was significant higher incidence of airway compromise in patients that had corrugated rubber drains compared to those that had plastic tube drains inserted ( $P=0.03$ ). However, the type of drain inserted was not an independent predictor of the presence of airway compromise in our patients. There were no significant differences between the two groups as regard retreatment and length of hospital stay. The insertion of open tube drain is as effective as the conventional corrugated rubber drain as it could decrease complications and improve the prognosis for patients with Ludwig's angina.

**Keywords:** Ludwig's Angina, drains, airway compromise, length of hospital stay.

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## INTRODUCTION

The use of commercially available or improvised drains in the management of Ludwig's angina is well documented [1, 2]. Commercially available drains are not often used in some health centres in the developing countries [3, 4], which makes improvised drains valuable choice materials in these settings. Among the commonly used commercially available drains are corrugated and Penrose rubber (latex) drains [5] while the improvised drains include plastic (polyvinyl chloride) tube drains fabricated from feeding tubes or drip sets [6]. The need to keep the abscess cavity patent for continuous, effective drainage, and to prevent premature closure of the abscess cavity cannot be over-emphasized [2].

There is no standard recommended guidelines regarding the choice of the appropriate drain in the management of Ludwig's angina and other severe odontogenic infections. While some authors have reported the use of corrugated drains [7, 8], the use of plastic tube drains [9, 10]. have also been reported in the literature. The surgeon's preference for any type of drain is often based on training, experience, and less on

scientific evidence. Time, cost, ease of use, availability, patient's comfort as well as tissue reactions are possible factors that could influence the choice of the type of drain [10].

To our knowledge, no study has compared the effectiveness of various types of drains in the management of Ludwig's angina. The purpose of this study is to determine the effectiveness of corrugated rubber and open tube drains in the management of Ludwig's angina patients with the aim of comparing their outcome on airway compromise, length of stay (LOS) and retreatment.

## METHODS

A retrospective study was designed for a sample of patients drawn from the population of patients with Ludwig's angina who attended for treatment at the Oral and Maxillofacial Surgery Clinic of our hospital in Nigeria from June 2008 to July 2018. The Ethics Committee of the hospital exempted the study from the review process because of its retrospective nature. Ludwig's angina was defined as involvement of the submental space, and the two

submandibular and sublingual spaces [10]. Patients with history of pregnancy, systemic disease and incomplete information in their records were excluded.

Data collected from case notes were age, gender, type of surgical drain, presence or absence of airway compromise, LOS, and retreatment. Swab for microscopy, culture and sensitivity (MCS) test was done for all cases before any surgical intervention and commencement of intravenous antibiotics. Incision and drainage was done for all patients under local anaesthesia using a horizontal submental incision and transverse submandibular incisions. Surgical drains were inserted in the incision sites after gaining access to

the spaces with the aid of the sinus forceps and establishing drainage. The drains were secured in place using sutures. All patients were started on empirical amoxicillin 1000mg/clavulanate 200mg injected intravenously 8-hourly and intravenous infusion of metronidazole 500mg 8-hourly for 5 days. This antibiotic regime is the institutional protocol and the antibiotics were only changed based on the result of the MCS. The cases were divided into two groups based on the type of surgical drain inserted: corrugated rubber drain (Figure 1 & 2) and open tube drain groups (Figure-3). The open drain tubes were prepared from polyvinyl intravenous fluid tube.



**Fig-1: A corrugated rubber drain**

Airway was defined as compromised if the respiratory rate and oxygen saturation were less than 25 cycles/minute and 95% respectively [11]. Retreatment in the form of a secondary revision of incision and drainage using the previous incision site was done in the presence of unremitting inflammatory parameters

[12] (temperature  $> 38.3^{\circ}\text{C}$ , WBC  $> 10.8 \times 10^3/\text{L}$  and persistent swelling) 72 hours after initial surgical intervention. The Otorhinolaryngologist performed awake tracheostomy on patients that developed airway compromise.



**Fig-2: A day 3 post-operative photograph of an 85-year old man with corrugated rubber drain insertion**



**Fig-3: Day 3 post-operative photograph of a 67- year old male with open tube drain**

Using descriptive statistics, continuous data were summarised as ranges, means and standard deviations while that of categorical data were summarised as frequency counts and percentages. In bivariate analysis, comparison between categorical variables was done with Chi-square of homogeneity while independent t-test was used for continuous variables. The IBM SPSS Version 21 was used to perform descriptive and inferential statistical analysis. All tests were 2-sided and *P*-value less than 0.05 was considered statistically significant.

## RESULTS

Of the 55 cases of Ludwig's angina studied, 32 (57.3%) had plastic tube drains while 23 (42.7%) had corrugated rubber drains inserted. Table 1 summarises the demographics and clinical characteristics of the seventy five cases studied. The age range of subjects was 19 – 72 years with a mean  $\pm$  SD of  $42.1 \pm 13.7$  years. There were 35 males and 20 females and the male to female ratio was 1.7:1. The overall incidences of airway compromise and retreatment 20% and 7.1% respectively. The incidence of airway compromise occurred more in male subjects 7 (63.6%) compared to the female cases 4 (36.4%). This observed difference was not statistically significant (*P* = 0.18). The overall average LOS was  $8.07 \pm 2.89$  days.

**Table-1: Demographic and clinical characteristics of patients in the study (n = 55)**

Variables	Values
<b>Age(years)</b>	
Range (Mean $\pm$ SD)	19-72 ( $42.1 \pm 13.7$ )
<b>Gender (n (%))</b>	
Male	35 (64.0)
Female	20 (36.0)
<b>Type of drain (n (%))</b>	
Corrugated	23 (42.7)
Tube	32 (57.3)
<b>LOS (days)</b>	
Range (Mean $\pm$ SD)	4-21 ( $8.07 \pm 2.89$ )
<b>Airway compromise (n (%))</b>	
Present	11 (20.0)
Absent	44 (80.0)
<b>Retreatment (n (%))</b>	
Present	4 (7.10)
Absent	51 (92.9)

LOS = Length of stay

The outcome demographic distribution and outcome measures between the two groups is shown in Table-2. The group that had corrugated drains were slightly older, but this was not statistically significant

(*P* = 0.31). The patients with corrugated drain insertions were found to stay longer in the hospital when compared with those that had open tube drains, although the observed difference was not statistically

significant ( $P = 0.61$ ). The incidence of airway compromise was 16.8% lower in the group with open tube drains. This difference was statistically significant ( $P = 0.03$ ). There were more cases 4 (10.5%) of retreatment in patients that had corrugated drains. However, this finding was not statistically significant.

Crude logistic regression between type of drain inserted and airway compromise showed that the type of drain inserted does not influence the incidence of airway compromise (OR=0.71, 95% CI = 0.13-2.51,  $P=0.64$ ).

**Table-2: Comparison of outcome type of drain insertion among both groups**

Variable	Group A (n=23)	Group B (n=32)	P-Value
<b>Age(years)</b>			
Range (Mean $\pm$ SD)	19-72 (44.5 $\pm$ 14.0)	20-70 (40.1 $\pm$ 13.4)	0.31
<b>Gender (n (%))</b>			
Male	12 (53.1)	23 (72.1)	0.42
Female	11 (46.9)	9 (27.9)	
<b>LOS (days)</b>			
Range (Mean $\pm$ SD)	5-21 (9.26 $\pm$ 3.61)	4-10 (7.09 $\pm$ 1.62)	0.61
<b>Airway compromise (n (%))</b>			
Present	5 (21.1)	2 (4.3)	0.03
Absent	18(78.9)	30 (95.7)	
<b>Retreatment (n (%))</b>			
Present	4 (17.4)	2 (6.3)	0.83
Absent	19 (82.6)	30 (93.8)	

Group A = Corrugated rubber drain group; Group B = Plastic tube drain group. LOS = Length of stay;

## DISCUSSION

Ludwig's angina is a rapidly spreading cellulitis affecting the soft tissues of the neck and floor of the mouth. It is a surgical emergency that requires urgent and precise steps in its management to forestall any imminent fatality. The leading cause of death from Ludwig angina is airway compromise and maintaining the integrity of the airway is of utmost importance in the management.

Incision and drainage are an integral part of the management of Ludwig's angina as it helps in decompression as well as improve airway. For continuous drainage, the use drains are essential and the efficacy of the drain to maintain patency of the drainage path should influence the choice of drain.

Evidence from case reports [13, 14] and review articles [15, 16] suggest that surgeons in developed countries and some clinicians in developing countries favour the use of corrugated rubber drains in the management of abscesses and cellulitis. This might as a result of corrugated drains been readily available. However, in developing countries, alternatives such as use of polyvinyl tube drains and surgical gloves are used as drains [3, 4]. This has raised the questions of how effective these alternatives are when compared to the established corrugated drains.

With the use of open tube drain becoming increasing used in place of the conventional corrugated drain in most hospital settings in the management of Ludwig's angina due to its readily availability, cost effective, and its biocompatibility with the tissues being a polymer of polyvinylchloride, the need to evaluate its efficacy is needed. There seem to be no studies in the

literature that have compared outcomes between open tube and corrugated rubber surgical drains in management of Ludwig's angina.

The incidence of airway compromise was significantly lower in the patients who had open tube drain insertions though the type of drain inserted was not an independent predictor of the presence of airway compromise in our patients. The reason for this significantly higher incidence of airway compromise in patient that had corrugated drain is not clear and no previous study has reported such a variation in the incidence of airway compromise following type of surgical drain inserted. The authors are not quick to promote the use of open tube drain on the basis of better airway outcome in this study as we realise that the preoperative state of the patient's airway was not documented. The result of future studies may confirm or refute the present findings.

The mean LOS of 8.07 days in the study was not at variance with documented reports in previous studies [5, 17]. Patients with corrugated drains had a mean stay of 2.17 days longer in the hospital than those with tube drains insertions. One would have expected the converse due to the higher chance of blockage within the lumen of the tube as supported by Bourke *et al.*, [18]. The higher airway compromise found with the group that had corrugated drains might have accounted for the patients staying longer in the hospital. Furthermore, in the absence of a blockage within the lumen of the open tube drain, the polyvinyl tube is more resilient to compression and can thus keep the incision site more patent [7]. This enhances faster and continuous drainage, leading to shorter duration of drainage, quicker resolution of the cellulitis and shorter LOS.



More patient that had corrugated rubber drain underwent second treatment in the form original incision re-activation and abscess cavity instrumentation to enhance continuous drainage. This was indicated in patient without reduction in swelling after 2-3days of first procedure. This finding could be ascribed to tube drains having better capacity to keep the incision opening patent to enhance continuous drainage.

The limitation of this study was its retrospective nature that hampered the availability of important data, which resulted in the exclusion of a significant number of patients from the study. Furthermore, the severity of the cellulitis was not graded in the case note thus making for uniform comparison. Only few studies were also available for comparison of data.

## CONCLUSION

Despite the observed drawbacks of a retrospective study such as this, we can still make some deductions. First, the use of open tube drain is as effective as the traditionally used corrugated rubber drain as it compared favourably in clinical outcomes measured. Second, in resource poor settings, open tube drain could serve as a viable alternative because of its comparative advantages of cost effectiveness, ready availability and good treatment outcome.

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