Comparison of clinical efficacy and safety between articaine and lidocaine in the anaesthesia management of tooth pulp disease

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Abstract: To evaluate and compare the clinical efficacy and safety between articaine and lidocaine in the anaesthesia management of tooth pulp disease. The 160 patients with tooth pulp disease treated at our hospital were enrolled. After informed consent was obtained, patients were randomly assigned to study group and control group, with 80 patients in each group. Of those, lidocaine was administered to the control group while articaine was given to the study group. The onset time, analgesic effect and adverse events were recorded. Compared with control group, the onset time was significantly reduced in study group ($p<0.05$). Patients treated with articaine had better analgesic effect than patients in control group ($p<0.05$). And the incidence of adverse events was notably lower in study group ($p<0.05$). Compared with lidocaine, articaine presents higher analgesic efficacy and safety for patients with tooth pulp disease.

Keywords: Articaine, lidocaine, tooth pulp disease, analgesic effect, safety.

INTRODUCTION

Tooth disease refers to diseases of tooth hard tissue. Broadly speaking, dental pulp disease falls into the category of tooth disease, presenting with acute or chronic pulp inflammation. It may frequently be accompanied by severe and intermittent pain. With the progression of disease, the duration of pain may prolong while pain-free intervals are shortened. Tooth pulp disease often requires surgical removal of pulp. As patient population increases and their quality of lives are severely affected, tooth pulp disease receives much attention (Su, 2015; Luan, 2015).

There are multiple types of tooth pulp disease (as shown in fig. 1), including total necrosis of pulp, acute pulpitis, chronic pulpitis, partial necrosis of pulp, chronic pulpitis with acute attack. Surgery serves as an important approach for treatment. However, with a rich network of nerves (as shown in fig. 2), pulp tissue would be rather sensitive to mechanical stimulation. Thus, effective analgesia is needed during the opening and removal of pulp, minimizing pain suffering (Qin, 2016; Wang, *et al*., 2016). At present, both articaine and lidocaine are clinically applied in the anaesthesia management of tooth pulp disease, resulting in varying effects. Cotti, Elisabetta, Zedda *et al*. made comparative analysis of the clinical effect of articaine and lidocaine on the anesthesia of dental pulp disease. The effective rate of dental pulp disease by articaine therapy was 97.69%, while that by lidocaine therapy was 75.60%. To further analyze the clinical effect of the two therapies, this research investigates the clinical efficacy and safety of articaine and lidocaine. In this research, the clinical efficacy and safety of articaine and lidocaine were evaluated and compared.

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MATERIALS AND METHODS

General data

A total of 160 patients diagnosed as tooth pulp disease and treated at our hospital from January 2015 to March 2018 were enrolled. This paper has a rigorous structure, and the conclusion has been approved by relevant ethics and relevant departments. Representative radiographic data is shown in fig. 3. Inclusion criteria are listed as follows: a definite diagnosis of tooth pulp disease, age 18 or older, obtain of informed consent, voluntary, compliant participants. And the exclusion criteria consisted of severe cardiac, hepatic or renal dysfunction, mental disorder, poor compliance, patients who recently had anticoagulants or contraindicated to articaine or lidocaine (Cotti, *et al*., 2015).

All patients were randomly assigned to study group and control group, with 80 patients in each group. There were 43 male and 37 female patients in the study group, including a total of 178 affected teeth. The average age was 60.3±2.8 years, ranging from 20 to 65 years. Moreover, there were 45 male and 35 female patients in the control group, involving a total of 183 affected teeth. The average age was 58.6±3.5 years, ranging from 20 to 63 years. In our study, data obtained from both groups were comparable ($P>0.05$).

Methods

Drugs used in our research: Articaine was purchased from French Bilan Company, with main components being 4% articaine hydrochloride and 1/100000 adrenaline. The lot number is GO132 and the specification of each is 1.7ml. Lidocaine was purchased from Beijing Yongkang Pharmaceutical Limited Company. The lot number is A070410 and the specification of each is 5ml.

Lidocaine was administered to the control group while articaine was given to the study group. Of those, articaine was injected at the lower site of labiobuccal apical mucosa, with a dosage of 0.6-0.8ml and 1.4-1.6ml for one root canal teeth and several root canals teeth, respectively. Lidocaine was also administered at the lower site of labiobuccal apical mucosa, with a dosage of 2-4ml.

Outcome measures

Analgesic effect of both group were observed and graded as follows: complete anesthesia, excellent anesthesia, effective anesthesia, ineffective anesthesia. Of those, complete anesthesia refers to an absolute painless state during operation while excellent anesthesia, effective anesthesia and ineffective anesthesia means slight pain but tolerable, considerable pain but tolerable, and severe pain that indicates inoperability, respectively. Also, the heart rate and blood pressure of all patients were recorded before anesthesia, immediately after anesthesia, 3 minutes after anesthesia and 5 minutes after anesthesia respectively. Finally, the onset time of anesthesia and incidence were obtained.

STATISTICAL ANALYSIS

Statistical analyses were performed using SPSS21.0. All quantitative data are expressed as mean±standard variance ($\bar{x}$ ±s), and comparisons were made with t-test. Enumeration data are expressed as natural number (n) and percentage (%) and comparisons were made with chi-square test. $p<0.05$ was considered statistically significant.

RESULTS

Comparisons of analgesic effect between both groups

Of 80 patients treated with articaine, 60 subjects developed complete anesthesia, 15 had excellent anesthesia, 4 had effective anesthesia and 1 presented with ineffective anesthesia, resulting in a total analgesic rate of 98.75%. However, among 80 patients administered with lidocaine, 35 subjects developed complete anesthesia, 20 had excellent anesthesia, 7 had effective anesthesia and 18 presented with ineffective anesthesia, resulting in a total analgesic rate of 77.50%. In general, the analgesic effect was significantly higher in the study group ($P<0.05$). All data are shown in table 1.

Comparisons of heart rate and blood pressure at different time points between both groups

As listed in table 2, no significant difference in the heart rate and blood pressure were observed before and after anesthesia ($p>0.05$). However, the heart rate of control group was significantly increased immediately after anesthesia, 3 minutes after anesthesia and 5 minutes after anesthesia ($p<0.05$).

Fig. 1: Tooth pulp disease

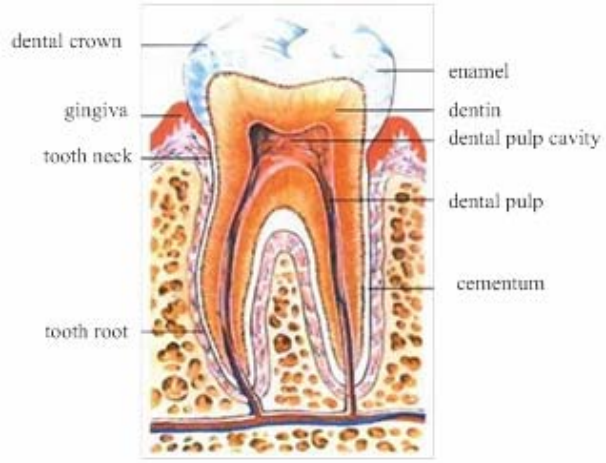

Fig. 2: Pulp

Fig. 3: Tooth pulp disease

Comparisons of the onset time of anesthesia and incidence rate between both groups

As shown in table 3, the incidence rate was significantly lower in the study group ($p<0.05$). Moreover, the onset time of anesthesia was noticeably shorter in the study group ($p<0.05$).

DISCUSSION

With the continuous improvement of living standards, people's dietary patterns and living habits are changing. Microbial infections (facultative anaerobes and obligate anaerobes such as chains Staphylococcus, Actinomycetes, Lactobacillus, etc.) resulted from bad eating habits could

Table 1: Comparisons of analgesic effect between both groups [n (%)]

Group	Number	Complete anesthesia	Excellent anesthesia	Effective anesthesia	Ineffective anesthesia	Total analgesic rate
Study group	80	60	15	4	1	79(98.75)
Control group	80	35	20	7	18	62(77.50)
X^2						9.18
p						

Table 2: Comparisons of heart rate and blood pressure at different time points between both groups ($\bar{x}$ ±s)

Group	Index	Before anesthesia	Immediately after anesthesia	3 mins after anesthesia	5 mins after anesthesia
Study group (n=80)	Heat rate (beats/min)	75.5±7.8	76.2±10.2	75.6±9.0	73.5±10.5
	Diastolic blood pressure (mmHg)	76.2±8.6	74.2±9.5	73.4±8.8	74.8±9.2
	Systolic blood pressure (mmHg)	118.6±13.2	118.5±14.9	118.2±13.0	119.5±11.5
Control group (n=80)	Heat rate (beats/min)	75.6±12.1	79.4±13.5	78.8±10.6	80.6±13.0
	Diastolic blood pressure (mmHg)	76.1±7.4	74.5±10.6	71.4±8.6	74.2±10.6
	Systolic blood pressure (mmHg)	118.3±13.6	118.6±15.3	113.5±12.0	119.6±14.7

Table 3: Comparisons of the onset time of anesthesia and incidence rate between both groups

Group	Number	Dizziness	Nauseous or vomiting	Arrhythmia	others	Incidence rate (%)	Onset time (min)
Study group	80	2	1	0	2	5(6.25)	2.1±0.8
Control group	80	5	4	4	2	15(18.75)	5.8±1.1
X^2/t							15.09
p							<0.05

lead to dental pulp disease. In recent years, the incidence of dental pulp disease has gain ascendency (Zhao, 2016; Zhang, 2017; Li, *et al*., 2016). Caries, a progressive disease of tooth hard tissue caused by a combination of multiple factors in the oral cavity, is manifested by inorganic demineralization and decomposition of organic matter. Dental caries is listed as one of three major human diseases together with cancer and cardiovascular disease.

One of the ways to treat dental pulp disease is surgery, which can achieve relatively good results. However, pulpectomy can cause obvious stimulation to the patient, inducing severe pain, hindering the successful performance of surgery and abrogating treatment effects (An, *et al*., 2016; Caplan, *et al*., 2017). Therefore, it is very important to implement safe and effective anesthesia in the treatment of dental pulp diseases.

Both articaine and lidocaine are common amide anesthetics. Compared with articaine, lidocaine is more frequently used. Studies have shown that lidocaine can help patients relieve pain. However, due to the abundance of nerve fibers in the affected tooth, some patients couldn't be completely relieved from pain. As a novel special narcotic drug for oral cavity, articaine mainly composes of epinephrine and articaine hydrochloride, etc. Of those, articacaine hydrochloride can block the nerve fiber conduction, producing local anesthesia. Meanwhile, adrenaline can promote the contraction of oral blood vessels, maintain a certain level of drug concentrations in local oral tissue, and ultimately enhance the effectiveness of anesthesia.

Results showed that the overall anesthetic efficacy was significantly better in the study group treated with articaine. Also, there were advantages of articaine over the control group regarding the onset time of anesthesia, incidence of adverse reactions and vital signs.

CONCLUSION

In conclusion, the number of patients with dental pulp disease is increasing, which has a serious impact on the normal quality of life of patients and has attracted wide attention from medical sphere. The articaine therapy has better and safer anesthetic effects than lidocaine therapy

in the treatment of tooth pulp disease. Articaine and lidocaine both belong to the amide type anesthetic drugs, but articaine is a new type oral anesthesia drug, which mainly consists of adrenaline, hydrochloric acid artetracaine, and has better local anesthesia effect. In this study, it was clearly observed that the anesthesia onset time of patients with articaine was shorter, the overall anesthesia efficiency of patients was significantly higher than that of the control group (i.e. lidocaine therapy group), and the incidence of adverse reactions was significantly lower than that of the control group. Therefore, the widespread application of articaine in dental pulp disease anesthesia is of great significance.

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