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EFFECT ON OPERATIVE BLOOD LOSS BY ADDING VASOCONSTRICTOR TO A LOCAL ANESTHETIC SOLUTION

by

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INTRODUCTION

Since the first report about blood loss in oral surgery (*Gores et al.*, 1955), several investigations have been published (*Johnson*, 1956; *Rossi*, 1957; *Connors*, 1959; *Kristerson & Nordenram*, 1964; *Rhymes & Williams*, 1964; *Spengos*, 1964; *Berdon*, 1965; *Curtis et al.*, 1966; *McIvor*, 1968; *Meyer & Allen*, 1968; *Rabinowitz et al.*, 1968; *Werner et al.*, 1968).

In three of these reports the effect of local injection of vasoconstrictors on blood loss is elucidated. *Gores et al.* (1955) examined the effect of a local anesthetic solution with epinephrine in patients to whom general anesthesia was administered. The blood loss was reduced on an average of 44 per cent compared with patients who received only general anesthesia. A corresponding procedure was carried out by *Curtis et al.* (1966). The reduction obtained was 33 per cent. *Meyer* and *Allen* (1968) measured blood loss in three groups of patients. In one group a saline solution was injected locally, in the second an epinephrine solution was injected, and in the third group a neosynephrine solution. A reduction of the operative blood loss was obtained in the last two groups, compared with the first one, but the differences were not significant. Abstracts from the results of these authors are given in Table I.

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Table I

Previous investigations of effect on operative blood loss by local injection of solution containing vasoconstrictors. In all cases multiple extractions were performed under general anesthesia

Author	Number of cases	Solution injected locally	Blood loss, ml average (range)	Method for measuring blood loss
Gores et al. (1955)	26	None	290 (61—771)	Colorimetric
	21	Piperocaine 3 per cent with epinephrine 1:100 000	161 (5—401)	
Curtis et al. (1966)	25	None	282 (77—524)	Colorimetric
	25	Lidocaine 2 per cent with epinephrine 1:100 000	189 (106—374)	
Meyer & Allen (1968)	14	Saline 0,86 per cent	397 (134—787)	Blood volume recording
	14	Epinephrine 1:100 000	327 (10—1031)	
	7	Neosynephrine 1:20 000	339 (144—704)	

As far as the author knows, no attempt has been made to compare blood loss in cases where a local anesthetic with and without vasoconstrictor is used. The aim of the present investigation was first to elucidate to what extent the addition of epinephrine to a local anesthetic solution will influence blood loss. Further it was intended to evaluate the usefulness of the local anesthetic solution without vasoconstrictor concerning frequency and duration of the analgesia and the view of the operative field.

MATERIAL AND METHODS

Among patients referred to the Department of Oral Surgery, the University of Bergen, 48 cases were selected, who were to undergo a root resection of a maxillary incisor, canine or premolar. Only patients in good health were accepted, and no one had a history of excessive bleeding. Cases where the surgical procedure would involve more than one tooth or the diameter of the periapical lesion exceeded 15 mm, were rejected. In 24 cases the root

Table II

Distribution of patients by sex and age

Anesthetic solution	Number of patients	Sex F	M	Age Mean ± s.e.
Carbocaine 2 per cent	23	13	10	37 ± 2,8
Carbocaine 2 per cent with epinephrine 1:100 000	25	14	11	32 ± 2,7

canal was filled during the operation, and in 8 cases a retrograde filling was made. In 16 cases the root canal was filled before the operation.

The subjects were divided into two groups. In one group of patients the local anesthetic solution was Carbocaine 2 per cent with epinephrine 1:100.000. One cartridge of 1,8 ml was injected as local infiltration, and supplemental injection was made if the patient reported any pain during the operation. In no case more than three cartridges were injected.

In the control group the anesthetic solution was Carbocaine 2 per cent without vasoconstrictor.

Distribution of patients by sex and age and in relation to anesthetic solutions is given in Table II.

Blood loss was measured by a volumetric method. The operative field was isolated by sponges and care was taken to avoid swallowing of blood or contamination by saliva. A known volume of saline solution was used for irrigation and the weight of sponges was recorded. The additional volume in the suction bottle and additional weight of sponges after the operation, was recorded as blood loss.

In five cases a comparison was made with a colorimetric method based on measuring the amount of hemoglobin collected from the operative field as described by *Curtis et al.* (1968). Values obtained by this method were from 1 ml to 5 ml higher than the corresponding values measured volumetrically, indicating that some blood or saline might remain in the suction system.

The test was undertaken as a double-blind study.

All operations were performed by the author.

No premedication was administered.

The significance of differences between means was tested with Student's t-test. When the variances were significantly different, corrections were made according to *Bailey* (1959).

Table III

Blood loss during root resections using local anesthetic solutions with and without epinephrine

Anesthetic solution	Number of patients	Blood loss (ml), mean ± s.e.	Level of significance
Carbocaine 2 per cent	23	31,5 ± 4,09	$p < 0,001$
Carbocaine 2 per cent with epinephrine 1:100 000	25	14,7 ± 2,11	

RESULTS

The average volume of local anesthetic solution was 2,2 ml in the vasoconstrictor group and 2,5 ml in the control group. Perfect analgesia was obtained in 92 per cent of cases in the vasoconstrictor group compared with 74 per cent in the control group. Also in those cases when a perfect analgesia was not obtained, the operations could be accomplished without great difficulty with the exception of one case where the patient belonging to the vasoconstrictor group was administered an infra-orbital block.

Mean values of blood losses are given in Table III. In the vasoconstrictor group blood loss ranged from 1 ml to 36 ml, and in the control group from 5 ml to 72 ml.

The mean blood loss of men was 15,5 ml. in the vasoconstrictor group and 30,9 ml in the control group. Corresponding values for women were 14,1 ml and 31,9 ml. Sex differences were not significant. Nor could any significant correlation between age and blood loss be demonstrated.

Bleeding during operations varied considerably from oozing to profuse. By means of an appropriate suction system a satisfactory view of the operative field could be obtained in all cases. An expression for a possible difference between the groups might be found in durations of operations. No difference was found, the mean duration being 22 minutes in both groups. An analysis of the four cases with greatest blood losses (from 58 ml to 72 ml) showed that the increased bleeding did not impede the surgical procedures, the mean duration of these cases being 23 minutes.

DISCUSSION

The observed values for blood loss in the vasoconstrictor group correspond well with the results of *Kristerson* and *Nordenram* (1964). No other report includes corresponding procedures.

Operative blood loss in minor oral surgical procedures most often is small. In this series the greatest value observed was 72 ml. Kristerson & Nordenram reported 331 ml as the greatest loss in a series of 1033 operations, comprising root resections, removal of impacted teeth, preprosthetic and periodontal procedures. From a point of convenience the addition of vasoconstrictor to a local anesthetic solution may give improved view of the operative field. In case an appropriate suction system is used this advantage seems to be negligible so far as minor procedures are concerned. As Carbocaine 2 per cent solution without epinephrine gave an imperfect analgesia in 26 per cent of cases, Carbocaine 3 per cent probably ought to be preferred if a local anesthetic solution without vasoconstrictor is to be used.

This investigation did not aim to evaluate post-operative blood loss. The report of *Meyer* and *Allen* (1968) indicates that if operative and post-operative blood losses are summarized, the difference between the groups might perhaps be insignificant.

SUMMARY

48 patients, who were to have a root resection of a maxillary incisor, canine or premolar, were selected for the study. The subjects were divided into two groups. In 23 patients the local anesthetic solution was Carbocaine 2 per cent, and in 25 patients Carbocaine 2 per cent with epinephrine 1:100.000 was injected.

The mean operative blood loss was 14,7 ml in the vasoconstrictor group and 31,5 ml in the control group. The greater blood loss did not influence duration of operations, the mean duration being 22 minutes in both groups. Carbocaine 2 per cent without vasoconstrictor gave an imperfect analgesia in 26 per cent of cases, and it is concluded that a solution of 3 per cent ought to be preferred. Post-operative blood loss was not measured.

RÉSUMÉ

ACTION DE L'ADDITION D'UN VASO-CONSTRICTEUR À UNE SOLUTION D'ANESTHÉSIQUE LOCAL SUR LA PERTE DE SANG OPÉRATOIRE

48 patients devant subir une résection apicale au niveau d'une insicive, d'une canine ou d'une prémolaire de la mâchoire supérieure ont été sélectionnés pour cette étude. Ils ont été divisés en deux groupes. Chez 23 patients, la solution anesthésique administrée était la Carbocaïne à 2 %, et chez 25 patients, on a administré une injection de Carbocaïne à 2 % avec 1:100000 d'adrénaline.

La perte moyenne de sang pendant l'opération était de 14,7 ml dans le groupe du vaso-constricteur, et de 31,5 ml dans le groupe témoin. La perte de sang plus élevée n'a pas influé sur la durée des opérations, la durée moyenne étant de 22 minutes dans les deux groupes. La Carbocaïne à 2 % sans vaso-constricteur donnait une analgésie imparfaite dans 26 % des cas, et l'auteur conclut que l'emploi d'une solution à 3 % serait préférable. La perte de sang post-opératoire n'a pas été mesurée.

ZUSAMMENFASSUNG

DIE WIRKUNG EINES LOKALANÄSTHETIKUMS IN KOMBINATION MIT EINEM VASOKONSTRIKTOR AUF DEN OPERATIVEN BLUTVERLUST

48 Patienten, an denen eine Wurzelspitzenresektion eines oberen Schneidezahnes, Eckzahnes oder Prämolarens vorgenommen werden sollte, wurden für die Untersuchung ausgewählt. Die Probanden wurden in zwei Gruppen eingeteilt. Bei 23 Patienten wurde das Lokalanästhetikum Carbocain 2 %ig injiziert und bei 25 Patienten Carbocain 2 %ig mit Epinephrin 1:100.000.

Der mittlere Blutverlust betrug 14,7 ml in der Vasokonstriktor-Gruppe und 31,5 ml in der Kontrollgruppe. Der grössere Blutverlust beeinflusste nicht die Länge der Operation die im Durchschnitt 22 Minuten in beiden Gruppen betrug. Carbocain 2 %ig ohne Vasokonstriktor führte in 26 % der Fälle zu einer unzureichenden Analgesie. Aus diesem Grunde sollte eine 3 %ige Lösung bevorzugt werden. Postoperativer Blutverlust wurde nicht gemessen.

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