Efficacy of Epinephrine Concentration in Local Anesthesia during Periodontal Surgery

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BLOOD LOSS IN PERIODONTAL FLAP surgery using lidocaine 2% with either 1:50,000 or 1:100,000 epinephrine was compared. Ten patients from the graduate periodontal clinic were selected for the study. After the initial therapy which included oral hygiene instruction, scaling and root planing and occlusal adjustment, 20 surgical procedures were performed. In any one patient if 1:50,000 epinephrine was used on the posterior sextant of an arch, then 1:100,000 epinephrine was used on the contralateral side, with similar volumes being injected by the same method. Blood loss was determined by the cyanmethemoglobin comparison technique. Procedures using lidocaine 2% with 1:100,000 epinephrine generally had more than twice as much blood loss as those using lidocaine 2% with 1:50,000 epinephrine.

Blood loss in various oral surgical procedures using local anesthetics has been studied by numerous investigators.[1-5] In periodontal flap surgery two studies[1,2] demonstrated that blood loss can be considerable and should be of concern to the practitioner. This blood loss can, in some cases, exceed that which occurs in major surgery. It may therefore be necessary not only to set up specific guidelines for potential fluid replacement but also to use anesthetic solutions containing vasoconstrictive agents which allow minimal hemorrhaging during periodontal surgery. Since lidocaine 2% combined with either 1:50,000 (0.02 mg/ml) or 1:100,000 (0.01 mg/ml) epinephrine is in wide use in periodontal surgery, this investigation compared the two concentrations relative to their effect on blood loss in comparable surgical procedures performed on the same patient. Epinephrine is the most potent and efficient of the vasoconstricting drugs used in dental anesthetic solutions. The safe arbitrary maximum dose for the healthy dental outpatient is 0.2 mg which is 10 ml (or 5.5 carpules) of a 1:50,000 concentration or 20 ml (or 11.1 carpules of a 1:100,000 concentration).[6]

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MATERIALS AND METHODS

Ten patients assigned to the graduate periodontal clinic were included in the study. Initial therapy on all patients included oral hygiene instruction, scaling and root planing, and occlusal adjustment. Upon completion of the occlusal adjustment, a re-evaluation indicated that surgical correction of periodontal defects was necessary in posterior sextants. None of the patients had any medical contraindications to surgery, nor had there been any aspirin intake at least 36 hours before surgery. Just prior to administering the anesthetic and performing the surgery, the following were obtained: a bleeding time, which measures the function of platelets as well as the integrity of the vessel wall, using the Duke method (normal range up to 6 minutes); baseline blood pressure, using the auscultatory method; pocket depth using calibrated Williams-Fox probes; and the gingival index of Loe.[7]

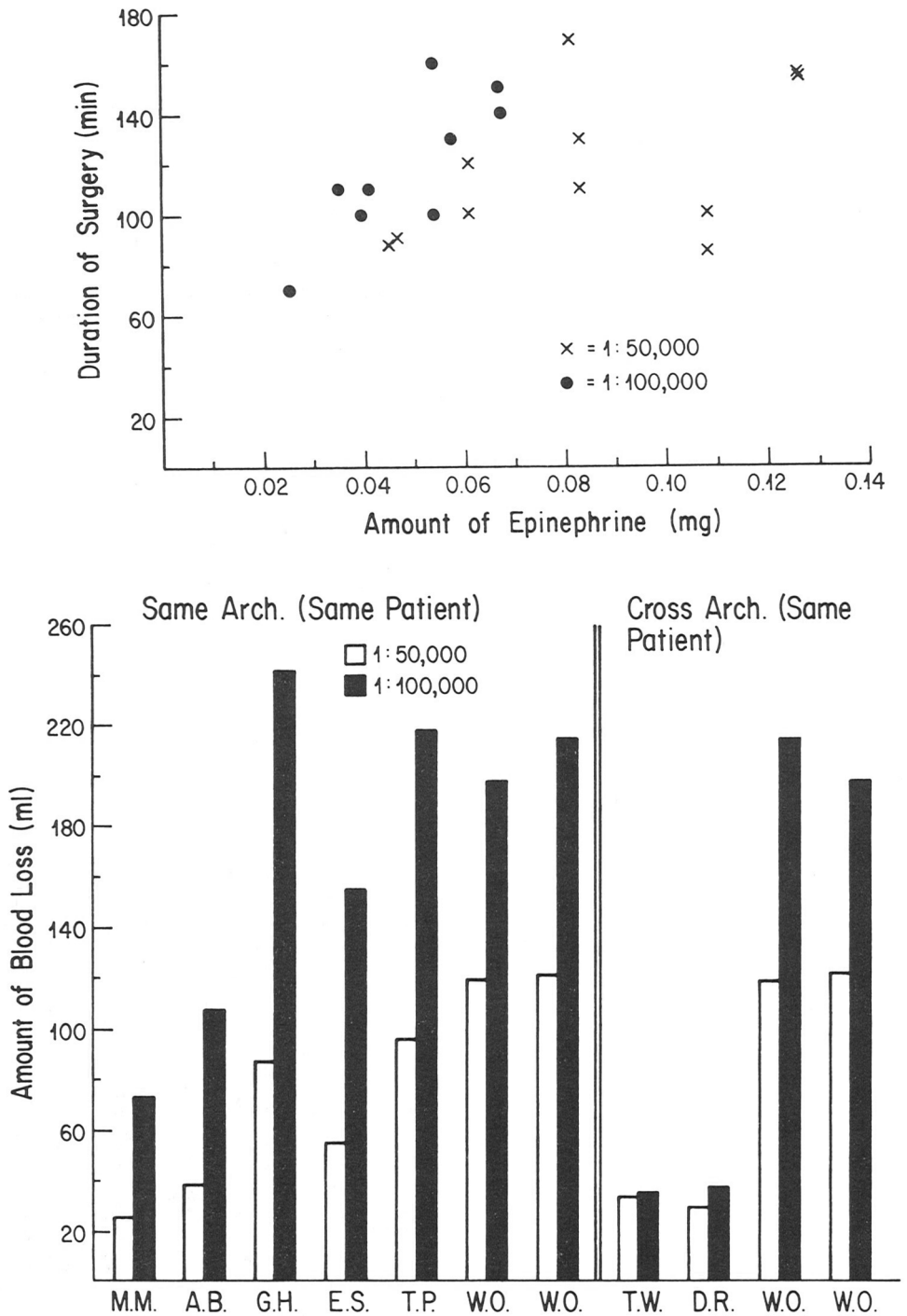
The range of pocket depths in the areas specified for surgery was approximately the same in all patients, and a gingival index of 1 or less was achieved and maintained prior to performing surgery. Bleeding times of all patients were within normal limits.

All of the 20 surgical procedures performed on these 10 patients were similar (periodontal flap surgery) and were carried out by the same operator using lidocaine HCl* 2% with either 1:50,000 or 1:100,000 epinephrine (block and/or infiltration). In any one patient if 1:50,000 epinephrine was used on one posterior sextant

* Xylocaine.

of an arch, 1:100,000 epinephrine was used on the contralateral side, with similar volumes being injected by the same method. All procedures were performed during morning hours since, according to Sunderman et al.,[8] there is a diurnal variation in hemoglobin concentration of as much as 10%.

Blood was collected using a portable suction unit (Gomco) and also 2 × 2 sterile gauze. The gauze was then rinsed out a minimum of three times to retrieve the blood absorbed. Three samples were taken from each surgical blood collection and analyzed for hemoglobin content within 6 hours of the completion of surgery. Blood loss was measured using the cyanmethemoglobin comparison technique[8] which has been demonstrated to be accurate within 2 to 3% of a known value of blood.[3,9,10] The concentration of hemoglobin (Hb) in the aspirated blood was measured at 540 nm using a Coleman Jr. Spectrophotometer. Blood loss was



Graph 1. Top, *duration of surgery (min) to the amount of epinephrine (mg) used in local anesthetic during surgery;* **Bottom,** *comparison of the amount of blood loss (ml) to the concentration of epinephrine (1:50,000 and 1:100,000) in the local anesthetic used during surgery in individual patients (Same and Cross Arch).*

calculated by comparing the concentration of the Hb in the patient's whole blood with the concentration of Hb in the collected blood times the volume of collected blood. At the end of the surgery a final blood pressure was obtained.

RESULTS

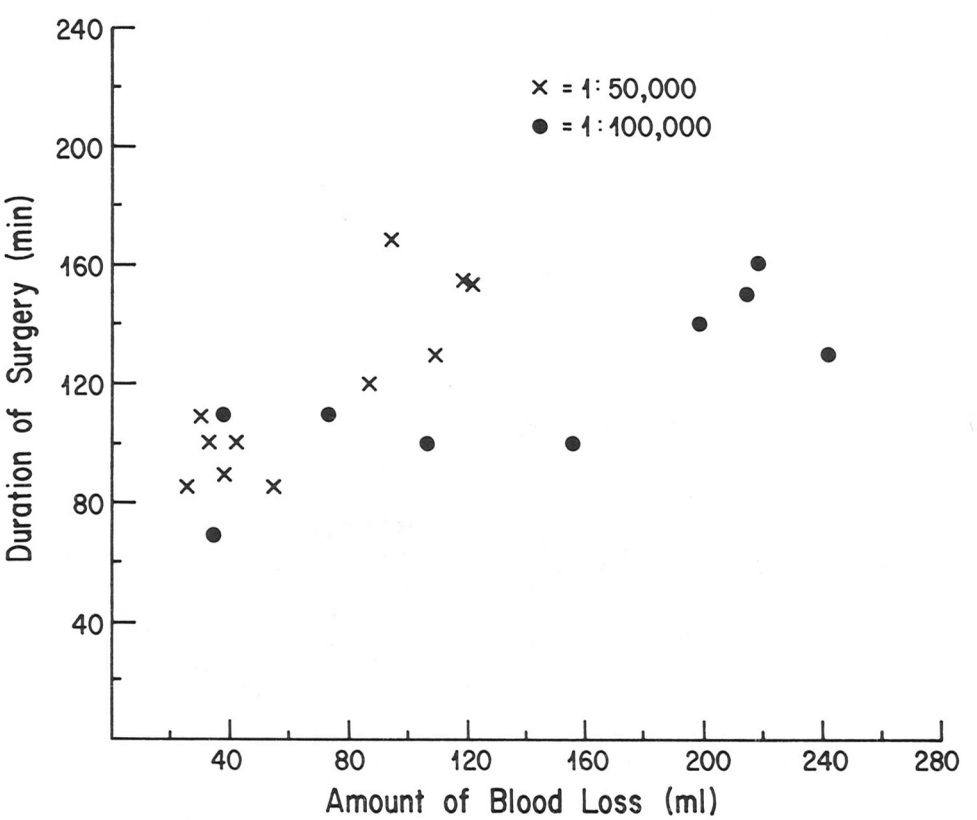
Graph 1 (Top) shows the relationship between duration of surgery (minutes) and the amount of epinephrine (mg) used in anesthesia during surgery. Generally, the longer procedures required the larger quantity of epinephrine. The range of volume of anesthetic solution and time for surgery were approximately the same for both groups (1:50,000 and 1:100,000 epinephrine); however, patients who received lidocaine HCl 2% with 1:50,000 epinephrine had considerably less blood loss, whether the comparison involved the same arch or cross arch Graph 1 (Bottom).

This comparison is also shown in Graphs 2 and 3. Graph 2 relates duration of surgery to quantity of blood loss. As the time for surgery increased, so did the blood loss; however, blood loss in the 1:50,000 epinephrine group was always considerably less than in the 1:100,000 epinephrine group. Graph 3 compares the amount of blood loss (ml) and the amount of epinephrine (mg) used during surgery. Here one can see that 50% of the 1:100,000 epinephrine group exceeded blood loss of 140 ml or more, whereas none of the 1:50,000 epinephrine group exceeded 140 ml blood loss. Although a slight increase in the patients' blood pressure was noted at the end of surgery compared to their baseline blood pressure, all patients were still classified as physical status 1 (less than 140 mm and less than 90 mm Hg blood pressure) according to the American Society of Anesthesiologists.

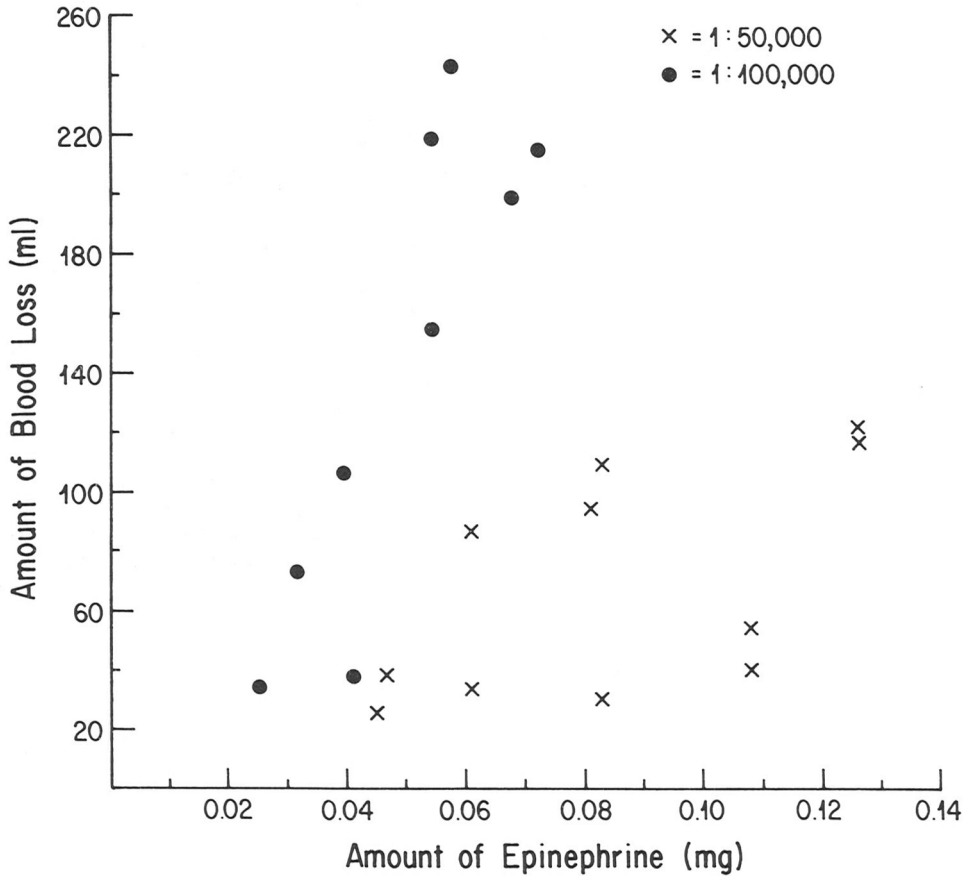
DISCUSSION

The blood loss which occurs during periodontal surgery has been shown to be considerable in several studies. Postoperatively, blood loss has been shown to be equal to or greater than surgical blood loss following full mouth extractions.[11,12] Prolonged postoperative bleeding may occur when aspirin has been taken, particularly in certain aspirin-sensitive individuals. McGaul[13] showed that when periodontal flap surgery was performed in four quadrants on an individual patient, each quadrant done on a separate occasion, postoperative bleeding occurred only in the two quadrants where aspirin had been taken.

Although blood loss did not exceed 242.46 ml in this study, it has exceeded 500 ml in other studies,[2] and several investigators recommend that blood losses greater than 500 ml should be replaced immediately with intravenous fluids or whole blood.[3,14,15] However, presurgical measures should also be taken to help reduce this volume loss. Bleeding, clotting and prothrombin times should be routine in patients with suspected bleeding tendencies, although there have been reports



Graph 2. *Duration of surgery (min) in relation to the amount of blood loss (ml) occurring during surgery.*



Graph 3. *Amount of blood loss (ml) in relation to the amount of epinephrine (mg) used in local anesthetic during surgery.*

that bleeding, clotting and prothrombin times can be within normal limits in an individual who bleeds profusely.[1,4,14] Heparin, dicoumeral and derivatives, as well as aspirin intake, should also be reduced or eliminated 36 hours prior to any surgery because of impairment of platelet function and reduction in prothrombin formation even in normal subjects. Another presurgical consideration would be the utilization of an anesthetic solution that contains a sufficient concentration of vasoconstrictor. In this study, blood loss was considerably reduced by using anesthetic with 1:50,000 epinephrine. Also, since blood volume loss was reduced, the surgical site was easier to visualize, which in most cases will reduce the time necessary for the operation, and make hemostasis at the end of surgery easier and more efficiently obtained.

According to Monheim,[6] the effects of epinephrine on the cardiovascular system are numerous and complex, with the response of individual patients varying greatly. Epinephrine stimulates the heart by direct action on the myocardium, increasing the cardiac rate, force of contraction, and output. The blood sugar level may be raised by epinephrine, provided sufficient glycogen is present in the liver. It is even possible for some patients to develop a tolerance to the drug. In the concentrations used in dental practice, epinephrine exhibits an extremely low toxicity. Its action is of short duration since it is relatively unstable and undergoes biotransformation rapidly. The vasoconstricting effect of epinephrine, which slows its absorption, and its short duration are factors in reducing its overall systemic toxicity. Reactions to this drug, other than a transient stress syndrome, are uncommon, unless it is used in too great a concentration or inadvertently administered intravenously, in which case, the most minute amount of the drug, particularly in susceptible individuals, may give rise to exaggerated side effects such as marked elevations in blood pressure, tachycardia, cardiac arythmias and severe headache. The severity of these effects depends on the dosage and method of administration.

Epinephrine should not be used on hyperthyroid patients since they are particularly susceptible to this drug. Its use should also be limited in the arteriosclerotic patient. In patients having organic heart disease, particularly recent coronary artery occlusion or myocardial degeneration, it would be best to limit the total dosage of epinephrine to 0.04 mg, or if lidocaine HCl or 3% mepivacaine HCl were to be used, the vasoconstrictor could be eliminated entirely.[6] A special report of the New York Heart Association in 1954 concluded that there is no hazard for the cardiac patient if no more than 0.2 mg of epinephrine is used at a single dental appointment.[16] It has been stated that 0.5 mg of epinephrine is the effective dose for positive or pressor

effects in man when injected subcutaneously.[17] This is two and one-half times the maximum amount advised by the New York Heart Association; and it represents 50 ml of epinephrine 1:100,000.

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Abstracts

Gingival Bleeding after Chlorhexidine Rinses with or without Mechanical Oral Hygiene

Asikainen, S., Sandholm, L., Sandman, S., and Ainamo, J.
J Clin Periodontol **11:** 87, February, 1984

A split mouth approach was used in 30 dental students for 7 days to evaluate the increase in gingival bleeding tendency after the use of chlorhexidine rinses. One-half of the mouth was brushed and then a rinsing with 0.2% chlorhexidine digluconate solution was performed for 1 minute. The plaque index (PI) and gingival index (GI) were evaluated and recorded at baseline and at the end of the experiment. Both were low at baseline and at the end of the experiment, the low PI scores were further reduced on both sides of the jaws. However the PI scores were higher in the areas of rinsing only than the areas of rinsing and mechanical cleaning. The tendency of bleeding was found to decrease in the areas of brushing and to increase in the areas of rinsing only. The increased tendency was more prominent in those students with healthier gingiva at baseline. The increased bleeding tendency may be associated with the accumulation and irritation from debris-pellicle, leukocytes and epithelial cells which prevent entrance of chlorhexidine into the sulcus. *Department of Periodontology, Institute of Dentistry, University of Helsinki, Mannerheimintie 172, SF-00280, Helsinki 28, Finland.*

Dr. Andres Parashis

Frequency of Desquamative Gingivitis in Skin Diseases

Sklavounou, A. and Laskaris, G.
Oral Surg **56:** 141, August, 1983

A study consisting of 453 patients was performed to correlate the frequency of desquamative gingivitis in chronic bullous dermatoses such as pemphigus vulgaris (PV), lichen planus (LP), bullous pemphigoid (BP) and cicatricial pemphigoid (CP). The patients were divided in 4 groups as follows: Group A: 157 patients with pemphigus vulgaris, intraoral lesions developed first in more than half of the cases; Group B: 62 patients with bullous pemphigoid in which small bullae developed intraorally; Group C: 55 patients with a chronic vesicular disease which involved the oral cavity and other mucous membranes, cicatricial pemphigoid, a desquamative type of gingivitis commonly seen; Group D: 179 patients with lichen planus in which the intraoral lesions were keratotic, ulcerative or atrophic in appearance. The results demonstrated that cicatricial pemphigoid is the condition where gingival lesions in the form of desquamative gingivitis are most frequently found. Although desquamative gingivitis is not a true disease, it represents a clinical manifestation and finding the underlying cause is important. *Dr. G. Laskaris, 20-29 Ipsilandou St, Athens 140, Greece*

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