Diazepam in Dentistry

Clinical observations based on the treatment of 167 patients in general dental practice.

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Introduction

The past decade has seen a growing interest in the use of intravenously administered drugs for dental procedures, particularly restorative dentistry for nervous, apprehensive patients who, through fear, might otherwise not receive proper care; and for those patients where time is valuable and who prefer to complete their treatment in as few visits as possible. This interest has been largely stimulated by the introduction of methohexital sodium, an ultra-short acting intravenous anesthetic with reduced side effects and cumulation[1], and more recent non-barbiturate anesthetics[2]; as well as the intravenous use of various drug combinations which produce basal narcosis upon which minute increments of methohexital may be superimposed whenever it is necessary to temporarily deepen the level of sedation[3, 4]. Additional analgesia is usually provided by the administration of local or regional analgesic agents.

With the principle in mind of "the lighter the level, the safer the patient" an early attempt was carried out based on the use of methohexital to produce sedation and amnesia only, supplemented with local analgesia as required[5, 6, 7]. This technique has proved of inestimable value for the short case of up to half an hour, but has certain disadvantages for longer cases where larger total dosages of methohexital are required, leading to some cumulation and increased recovery times. A further disadvantage of methohexital alone is seen with a small proportion of patients where excessive restlessness 2—Anesthesia Progress 567 11-6 dgl and muscular activity occurs, probably due in some instances to idiosyncrasy to the methyl groups present in the methohexital molecule, but undoubtedly associated in others with psychological stresses not always related to dentistry, where the barbiturate appears to release suppressed emotional tension.

In the authors' opinion it is only necessary to produce relaxation, sedation and amnesia in order to successfully treat most apprehensive dental patients, and that analgesia can at present be provided by the supplementary use of local analgesic drugs; although it appears possible that in the near future newer drugs may provide this feature also.[8]

Such sedative/amnesic techniques also negate the criticism of "operator-anesthetist" as they aim at the avoidance of general anesthesia and the maintenance of the patient in a state where he can converse with the operator, is in full possession of all his protective reflexes throughout, recovers rapidly following completion of treatment, yet is often totally amnesic for what might normally have been a very unpleasant ordeal.

With these aims in mind, an attempt was made to develop a method for the treatment of longer cases using intra-

venous diazepam (Valium) to produce basal narcosis, upon which minimal increments of methohexital were superimposed as required.

Pharmacology

Diazepam (7-chloro-1-methyl-5-phenyl-3H-1,4-benzodiazepin-2(1H)-one), a benzodiazepine tranquilizer, is an analogue of chlordiazepoxide (Librium) to which it is chemically and pharmacologically related. It is supplied in ampoules containing 5 mg/ml of a yellowish, rather viscid solution. Diazepam has been used as a pre-operative medication[9, 10] to alleviate muscle spasm[11], in psychiatry[12] in cardioversion[13] and as an anaesthetic induction agent[14].

As a muscle relaxant, diazepam has proved much more effective than chlordiazepoxide[9]. It retains the low toxicity of chlordiazepoxide but possesses higher potency, producing profound calming and sedative effects without extrapyramidal side effects or autonomic blocking. Given alone, even large doses of diazepam appear to produce little effect on respiratory or cardiovascular stability[14, 15] although some workers disagree with this finding.[16] It is suggested that the speed of injection may be an important factor in the production of side effects. It should be noted also that in the authors' experience diazepam appears to have a marked potentiating effect on other drugs, which could lead to complications if this factor is not considered. Liver function studies have not demonstrated any hepatic dysfunction.[14]

Commonest side effects noted by other workers are sedation and dizziness, ataxia, pain during injection of undiluted drug, and venous thrombosis. No venous thrombosis was noted in the present series, where the drug was administered in diluted form through fine 25 gauge needles, and the speed of injection was maintained at a rate not exceeding 2mg/30 secs. Only moderate analgesia is produced by diazepam, but there is no evidence of antanalgesia[14]. Amnesia is an important feature of this drug which has been noted by most other workers, although this did not appear to be consistent in our experience where diazepam was administered alone. There appears to be a latency of about 1 minute in the onset of sedation, and a great individual variation in response to the drug.

Methods Used

(a) Unsupplemented Diazepam

Diazepam was first administered with atropine sulphate 0.3-0.6 mg in doses ranging from 5-20 mg, preceding the injection of local analgesics[17,18]. Atropine was used primarily for its antisialogogue action. In all cases induction was carried out with the patient supine[19].

A 10 ml syringe was loaded with two 2 ml ampoules of diazepam (20 mg) and one 1 ml ampoule of atropine (0.6 mg) to make 5 ml. Water for injection was then added to fill the syringe to the 10 ml mark and the syringe shaken to allow even distribution of diazepam throughout the solution.

Injection was then performed at a rate no greater than 1 ml/30 seconds (2 mg/30 seconds) until the patient noted the first symptoms of relaxation and sedation. This was often quite dramatic with extremely apprehensive patients, where nervous tension disappeared rapidly, and comments such as "I couldn't care less about having my teeth drilled now" were commonly heard. At this stage, local analgesics were administered, followed by the

operative treatment. 27 patients were treated using unsupplemented diazepam.

Discussion

The use of diazepam in this manner produced good results with short cases of up to half an hour, but amnesia (which we felt was a desirable characteristic and which is always a feature of methohexital sedation) was variable, ranging from total amnesia to total recall—although few patients complained of this subsequently, even though they realized treatment was being carried out. However, it was felt that ideally, it was preferable to aim at complete amnesia if at all possible, due to many patients stating that they would prefer to know nothing of what was being done. Also, patients often discusssed their treatment with friends, who sometimes became upset at the prospect that they might be aware of what was happening, and couldn't see themselves happily accepting treatment under these conditions. A further disadvantage, with longer cases, was that the initial effect of diazepam had usually dissipated within 20-45 minutes.

Accordingly, it was decided to try to obtain the best of both worlds by combining diazepam as "basal sedation" with minimal increments of methohexital, to reinforce amnesia as well as to deepen sedation when required to cover particularly unpleasant procedures.

(b) Diazepam supplemented with methohexital

Following an initial induction with diazepam as in (a) to a stage of relaxation and light sedation, the syringe containing diazepam was removed and the extension from the intermittent methohexital apparatus connected to the indwelling needle. (Unlike Berns' method[4] where meperidine and methohexital are not miscible, no precipitation occurs with diazepam and methohexital). (*See postscript*)

5-10 mg of methohexital (0.5-1 ml of 1% solution) was then injected slowly and the patient closely observed. Often, this was sufficient to produce a marked increase in sedation within one minute, but where this was ineffective, further 5 mg increments were added as considered necessary. At this point, it should be stressed that in our experience the prior injection of diazepam leads to considerable potentiation of methohexital, thus dosage of the latter drug must be greatly reduced in order to avoid producing deeper levels approaching general anesthesia.

These periods of deepened sedation, lasting up to five minutes, were then used to cover the administration of local analgesics, extractions etc., while the patient slowly emerged to the lighter plane of basal sedation provided by the diazepam. 140 cases were treated using diazepam supplemented with methohexital.

Discussion

Using this technique, it was possible to work on many patients for up to two hours before the need for larger and more frequent increments of methohexital became apparent, suggesting a decrease in the activity of diazepam. To date, we have not treated cases exceeding two hours with this technique, although there would seem no objection to the addition of a further, reduced dose, of diazepam to the system when the demand for increased dosage of methohexital becomes obvious. However, we still feel that the intravenous premedication technique described by Jorgen-

sen[20] has advantages for very long cases, mainly due to reasons of simplicity in initial administration; as well as allowing rest periods for both patient and operator when desired without the need for subsequent reinduction, due to the longer acting drugs employed in the latter method.

The combination of diazepam and methohexital, however, offers considerable advantages. The opportunity to reduce barbiturate dosage significantly is particularly attractive, and it is not uncommon to find 10 mg diazepam and 100 mg methohexital (in 5-10 mg increments) sufficient for cases lasting up to two hours, whereas had methohexital been used as the sole agent, much larger dosages would have been required. Although we have not had the opportunity of confirming clinical impressions with circulating blood levels of the drugs under consideration, it is apparent that patients are usually very alert at the conclusion of treatment, as indeed they are following the use of methohexital alone. However, where a larger dose of barbiturate has been used it is probable that the apparent rapid recovery is due more to rapid redistribution of methohexital than to true detoxification. Thus we feel that recovery following the use of the diazepam/methohexital combination is more real than apparent, due to the reduced dosages of the drugs employed, particularly the barbiturate.

The opportunity was also taken of comparing the diazepam/methohexital combination with methohexital as the sole agent for 24 patients who, on previous occasions, presented management problems due to increased motor activity and restlessness. In 18 of these cases, it was gratifying to find that there was a tremendous improvement, probably due to the anxiolytic and relaxant properties of diazepam. With the 6 remaining exceptions, restlessness usually began following the addition of barbiturate and was reduced when it was withdrawn. It thus appears that some patients have a true idiosyncrasy to barbiturates, and in such cases some other means must be employed; perhaps the use of diazepam alone, in increased dosage.

Diazepam 10 mg is now also prescribed orally for patients presenting with extreme apprehension at the initial consultation, to be taken before retiring the night preceding treatment in order to ensure a good night's rest. The drug would also appear to have value as oral premedication before dental surgery, particularly with children,[21] with considerable advantages over traditional premedicants such as secobarbital etc. However, the usual problems of oral premedication still apply (difficulty in assessing individual dosage, differing rates of gastric absorption etc.) but we feel it has definite value as a nocturnal sedative, with shorter duration, greater safety, and less side effects than longer-acting barbiturates.

Precautions and Contra-Indications

As with all intravenous procedures, this technique should not be undertaken unless the essential requirements of adequate training in anesthesia and resuscitation, and proper facilities have been complied with. As noted earlier, overdosage with methohexital could lead to the production of general anesthesia where diazepam has been administered initially, and the operating team must be capable of managing an unconscious patient and any emergency which may arise. However, by the carefully controlled use of small incremental doses of methohexital (which on no occasion should exceed

10 mg) an experienced operator will encounter little difficulty in maintaining the patient at the light sedative/amnesic plane desirable—particularly those with experience in the earlier techniques introduced by Shane and Berns[3, 4].

Venous thrombosis has not occurred in our series to date. Some patients have complained of slight pain during injection, which may have been due to the temperature of the solution; as similar effects have been noted with methohexital alone during cold weather. It is considered important, however, to use dilutions alone during cold weather. It is considered important, however, to use dilutions of at least 2 parts water for injection (or normal saline, 5% dextrose) to 1 part diazepam in order to both reduce the possibility of irritant side effects and to facilite painless venepuncture and easier injection through the fine 25 gauge needles used, which would be difficult with the undiluted, viscid solution.

Although teratogenesis has not been demonstrated in animal experiments with diazepam to date, this finding cannot necessarily be correlated to the treatment of human patients, and diazepam should not therefore be administered to any pregnant patient.

Cardiovascular stability and lack of respiratory depression are important advantages of diazepam (with the reservation that other drugs—and their side effects—may be potentiated) but it is considered essential that this technique, along with other intravenous methods currently gaining favor in dentistry, should only be used when the patient is supine[19]. Treated in this position, the patient is protected against any sudden falls in blood pressure and decreased cerebral oxygenation, and should be kept supine for at least one hour following the initial induction. The supine position is also complementary with the system of dentistry proposed by Beach[22].

As with all patients receiving dental treatment, whether by intravenous methods or simple local analgesia, a comprehensive medical history is mandatory and all the usual contraindications to anesthesia apply to the technique described—with particular reference to drugs currently being prescribed by medical practitioners.

All patients must be accompanied home after treatment by a responsible person, and supervised until completely recovered, as post-operative amnesia is unpredictable in both degree and duration.

Summary and Conclusions

A technique has been described which, in the authors' experience has already proved invaluable in the treatment of difficult and apprehensive dental patients, and is worthy of further investigation. Dentistry has long suffered a poor public image, and methods which allow for the proper treatment of nervous patients and others, painlessly and safely, will do much to improve this image. The use of diazepam/methohexital to produce sedation and amnesia appears to possess a high degree of safety and patient acceptance. Naturally, proper training in anesthesia and related techniques are essential before undertaking intravenous procedures. Unfortunately, this training is not always easy for a dentist to obtain, but it is to be hoped that improved facilities will be provided in the future.

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Postscript

"It appears that the solution of diazepam I have been using in New Zealand has a different solvent to that of the American product, which does not produce any precipitation on dilution or in combination with the other drugs used in the technique described in the article recently submitted (i.e. atropine and methohexital). Dr. A.M.C. Duffus, the Medical Director of Roche Products Ltd. in England, informs me that the English product has recently been changed so that precipitation *will* occur with dilution, and that supplies reaching New Zealand in the near future will likewise present problems. I have written to Dr. Duffus asking the reasons for the change in the solvent, as well as for information concerning compatibility with other drugs, and diluent solutions.

"Thus, it appears I shall shortly find it necessary to alter the technique as follows:

"1. *Undiluted* (failing there being any compatible diluent) diazepam will be injected to produce initial cortical symptoms, and the indwelling needle will be flushed with aspirated blood to remove any traces of diazepam.

"2. The extension from the intermittent methohexital apparatus will be then connected to the needle and the technique proceed as already described. (similar to Dr. Shane's technique where hydroxyzine is used instead of diazepam).—and Professor Jorgensen's technique, where pentobarbitone and meperidine are not miscible.

"As I have not yet used the new solution, it is hoped that it is not as viscous as the present one in use, as this will require the use of larger needles. It is also hoped that the possibility of venous thrombosis (which has not yet occurred in what is now over 300 cases) will not be increased. I feel that dilution as described has probably assisted considerably in the prevention of this problem."

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