

Painless Hair Transplantation

DAVID SEAGER, MD

ABSTRACT: This article presents an overview of the use of local anaesthesia during Hair Transplantation including a description of potential complications and their management. The basic principles of administering appropriate sedation and local anaesthesia for hair transplantation will be outlined. Painless Hair Transplantation should be effectively achieved by novices in their first case provided the protocol described is strictly adhered to. Included in this article are suggestions to help the Hair Transplant Surgeon avoid potential complications associated with such medications and to competently manage any complications which may arise.

Key Word: *Please supply*

GENERAL CONSIDERATIONS

Good local anaesthesia begins at the first preoperative consultation. It is important to obtain the total confidence of the patient. This begins with the patient's initial perception of the surgeon and the surgeon's staff. During both consultation and surgery, one should avoid any reference to "cutting," of blood, sharp objects, such as needles and scissors, etc. and during surgery, the patient should not be able to see any sharp surgical instruments or blood stained gloves, or swabs. To ensure this, the patient should be approached and worked upon from behind. During surgery, either soft music should be playing to distract the patient, or the patient should have his/her attention gripped by watching a video.

PRE-MEDICATION

The importance of pre-medication with benzodiazepines is, in the author's opinion, paramount. There are three main effects of benzodiazepine pre-medication. One is reduction of anxiety (anxiety decreases pain threshold). Two: it induces amnesia and in the case of intravenous midazolam, extremely profound amnesia. The third is that benzodiazepines counteract the early neurological toxicity of local anaesthetics.

I divide my hair transplant patients into two groups for the purposes of determining the method of sedation and administration of local anaesthesia. The first group are those to whom I will not administer significant amounts of benzodiazepine. These include patients with any chronic obstructive pulmonary disease (in whom significant seda-

tion with benzodiazepines is strictly contraindicated) and also patients with significant compromise of any of their medical systems, such as coronary artery disease, or even simply a frail, elderly patient. To this group I would give 5 to 10 mg of PO Valium. Also included in this group are a small minority of patients who simply decline to receive any sedation. Some of these patients say they would sooner tolerate pain rather than be "out of control" or "spaced out."

The second group of patients, probably 98% of all patients upon whom I perform hair transplantation, I give more profound benzodiazepine sedation, for the above mentioned reasons. My preferred method is to slowly administer intravenous midazolam (VERSED) over a five minute period. This is my agent of choice because of its brief duration of action and profound amnesic properties. Dosage of midazolam is more dependent upon age than weight, and under the age of 55 years, the average healthy patient requires about 3 to 5 mg IV and over the age of 55 years, about 1.5 to 2.5 mg. IV. The drug is slowly given in increments of about 20% of the anticipated total dosage (just mentioned) every one and one half minutes. Use of a pulse oximeter and automatic monitoring of BP pulse rate and E.C.G. are mandatory. During this slow administration of the midazolam, the patient is engaged in polite conversation, which allows for assessment of the patient's present intellect. When the patient's intellect becomes mildly impaired, but prior to dysarthria and diplopia, the patient is adequately sedated. It might alternatively be described that the patients are sedated to the same extent as if they were slightly drunk.

They have come nowhere near to losing their gag reflex and in this condition of mild sedation they are still able to walk out of the operatory into the washroom, etc. Provided their intellect has been slightly impaired with midazolam, the resulting degree of amnesia is usually sufficient so that even if the patient complains bitterly about pain from the

Send correspondence to: David Seager, M.D., Seager Hair Transplant Centre, 2863 Ellesmere Rd., The Court, Suite 401, Scarborough, Ontario, Canada, M1E5E9.

insertion of needles and the smarting of the injection of local anaesthetic, they will almost certainly, at the end of the surgery, declare that they felt no pain whatsoever! Patients who are fit for this significant degree of sedation but do not want to have any intravenous injection administered, may be given oral diazepam, 15 to 25 mg. PO, based on weight and age. This works, about 90% as effectively as intravenous midazolam. Having given significant benzodiazepine sedation, there is no need to use EMLA cream or Iontophoresis or even 30 gauge needles and buffering of the local anaesthetic. Local anaesthetic can be given as described below, quite rapidly and the patient will still be cooperative during the procedure and, in the vast majority of cases, will not recall any discomfort afterwards.

TECHNIQUE OF INJECTING LOCAL ANAESTHESIA

In the first group, who do not receive sedation, EMLA cream is applied under occlusive plastic dressing across the hairline and donor area which is going to receive a ring block with local anaesthesia. (See Figure 1) The EMLA is left on for two hours prior to surgery (This can be problematic in a busy hair transplant practice. Patients waiting around with EMLA and occlusive plastic on their head for two hours prior to surgery are not conducive to the smooth flow of patients through a busy hair transplant clinic. However, fortunately this subgroup represents only a very small percentage of total patients.) After the EMLA has been left on for two hours, it is removed and completely wiped away with alcohol. Next, a needleless injector, such as a Dermojet or a Stryjet or a Prestyl, (see Figure 2) is used to inject small amounts of local anaesthetic into the site where the ring block will be given. Needleless injector injections are made immediately adjacent to one another, producing "wall to wall" wheals as in Figure 3, using 1% Xylocaine with 1:100,000 Adrenaline. The EMLA makes the sensation of the needleless injector very tolerable. Next, in the donor area, 1% Xylocaine with 1:100,000 Adrenaline is injected via a 30 gauge needle into each of the wheals made with the needleless injector, (see Figure 3). This is also barely felt. The degree of anaesthesia affected by the needleless injector alone is not quite enough for surgery to progress and therefore it has to be reinforced



Figure 1. "Occlusive plastic about to be applied over EMLA cream where a ring block to the hair line will be performed."

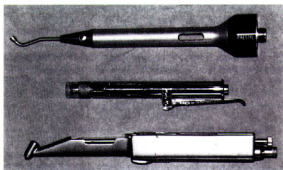


Figure 2. "Needleless injectors." Top The "Prestyl"—powered by compressed air—fastest to use but expensive and is temperamental in performance. Middle The "Dermojet"—the least expensive, most convenient to use and most reliable—but also causes the most pain on injection. Bottom The "Stryjet"—least painful for the patient—medium priced, and almost as reliable as the Dermojet, in the author's opinion.

via a syringe and 30 gauge needle, as in Figure 3. The same is done in the recipient area, using 2% Xylocaine, with 1:100,000 Adrenaline.

In the more heavily sedated group, it is not necessary to make the wheals with the needleless injector adjacent to each other, but just give them one "injection" with the needleless injector every one and one half inches or so. The rest of the ring block is affected with a 27 gauge needle injected through the wheal from the needleless injector; thus all piercing of the skin by a needle enters through a part of the skin that has already been anaesthetized to some extent. This is much faster than having to give numerous injections with the needleless injector, and then numerous vertical injections with the 30 gauge needle.

Important points to remember are, that the local anaesthetic must be injected high into the dermis, i.e. extremely superficially, just below the epidermis. A peau d'orange effect should be produced similar to when a tuberculin test

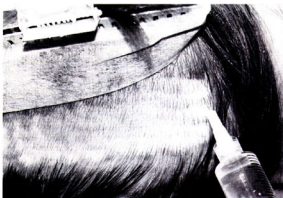


Figure 3. Xylocaine with Adrenaline being injected via a 30 Gauge Needle—very superficially into centre of wheals made with needleless injectors.

is given. Smaller amounts of local anaesthetic can be more accurately positioned into the high dermis using a smaller needle such as a 30 gauge or 27 gauge. If the local anaesthetic is injected into the low dermis, subcutaneous fat, or sub-galeal space, then it works less effectively, takes longer to work and is more rapidly absorbed systemically.

DOSAGE OF LOCAL ANAESTHETIC AND DURATION OF ACTION

During hair restoration surgery, a vasoconstrictor, usually Epinephrine, is mixed with the local anaesthetic. The main reasons are to limit absorption, enabling the use of higher total dosage and to prolong the duration of action. Most local anaesthetics are vasodilators and without the addition of Adrenaline, not only would the amounts of local anaesthetic solution necessary to anaesthetize the donor area and recipient areas usually be in toxic ranges, but also uncontrollable bleeding would frequently occur. (Note that in temporalis or occipitalis musculature, Adrenaline will have the reverse affect. It will not decrease bleeding, but increase it.) The vasoconstrictor effect of Adrenaline, often only lasts for 40 to 50 minutes. After this time, once the smooth muscle of the arteriolar walls relax, further Epinephrine frequently fails to produce further vasoconstriction. When planting long cases in the recipient area, after 45 minutes or so, the area may be infiltrated with further Adrenaline solution, prior to the vasoconstricting effect wearing off. During lengthy procedures the recipient area is frequently assessed for continued efficacy of the local anaesthetic. Patients are advised to inform the staff when they feel sensation beginning to return in the anaesthetized areas so that they can be re-anaesthetized at once. If they wait until the anaesthetic effect has completely worn off, re-anaesthetizing will be extremely painful; EMLA will not be satisfactory, and at this stage one is reluctant to give further significant sedation, or else the patient will take a long period to recover and not be ready to leave the office at the conclusion of the operation. Frequently, a whole hairline can be successfully re-anaesthetized with as little as 2 ml. of 2% Xylocaine with Epinephrine—injecting high in the dermis with a 30 gauge needle. Young patients, in general, are more difficult to locally anaesthetize and the effects of local anaesthetic has a briefer duration.

MAXIMUM DOSAGE OF LOCAL ANAESTHETIC SOLUTION

In a 100 kg man, the usual recommended maximum dose of 1% Xylocaine with Epinephrine is 70 ml. The maximum upper limits of 2% Xylocaine with Epinephrine is 30 ml in a 100 kg man. However, most patients do not weigh 100 kg and most 150 lb. patients, should not be given more than 50 ml of 1% Xylocaine with Epinephrine or the equivalent of 2% Xylocaine with Adrenaline, or mixtures thereof. However, under benzodiazepine cover, some hair transplant doctors have told me that they frequently give up to double these amounts without any evidence of side effects. I believe this is unnecessary and even under benzodiazepine cover with hair transplantation, I never give more than the above mentioned maximum dosages. However, during some scalp reductions, I have to exceed these traditional maximum doses, and in these cases I give generous amounts

of intravenous benzodiazepines. Throughout the procedure, the total amount of local anaesthetic used should be continuously totaled up on a flow sheet, so that at any point in the operation, one can tell exactly how much anaesthesia the patient has had so far (for the purposes of these calculations, I assume that only approximately $\frac{1}{3}$ of what was used with the needleless injector actually penetrated the skin. The remainder usually splatters off the surface without being injected).

OTHER METHODS

It must be mentioned that many other hair transplant doctors use fairly different methods of administering local anaesthesia and in their hands, achieve good results. The foregoing was a description of my own personal method which I find works well in virtually all cases. I find that 2% Xylocaine with Adrenaline is necessary for the more sensitive hairline and I usually give about 5 ml of this 2% across the anterior hairline for lasting effect. If this is done, then nearly all one's most sensitive patients will have effective local anaesthesia for at least one hour. Other doctors use mixtures of Lidocaine and bupivacaine (Marcaine). I, and other hair transplant doctors I have spoken with, have not found this mixture as effective as Xylocaine alone. When I have used Marcaine alone, I find it really doesn't last any longer in a vascular area such as the scalp than Lidocaine with Adrenaline. Some other hair transplant surgeons use the "tumescence" method of administering local anaesthesia. I, and most other hair transplant surgeons I have spoken to, find it presents difficulties when inserting grafts, and I have found no real advantage in using it myself. However, the tumescence method does have its proponents. Similarly, I personally never use nerve blocks for hair transplantation. I find that patients find them excruciatingly painful and they don't work as consistently, and in my hands, offer no advantage. However, I do use them for scalp reductions, but the details of performing nerve blocks are beyond the scope of this article.

ADVERSE REACTIONS AND THEIR TREATMENT

Respiratory depression from benzodiazepine sedation

In practice this is extremely rare, especially with the dosages I have described. Respiratory depression is related to dosage, speed of administration of benzodiazepine intravenously and whether or not it is given diluted or "neat." When benzodiazepines are given slowly in the low dosages mentioned and diluted with saline, significant respiratory depression is extremely rare. When it does occur, usually it is sufficient to shake the patient's shoulder and shout "wake up and breathe"—and that is just what they do, and their oxygen saturation comes right up again. The respiratory depressant effects of midazolam are reversed by Flumazenil which should always be kept immediately available. One, however, should be prepared to bag the patient with an Ambu Bag with 100% oxygen, and the surgeon or other staff present should be trained in ACLS and be prepared for the possibility of one day having to insert an endotracheal tube with a laryngoscope, all of which equipment should be available. Other side effects

from benzodiazepine, include hiccups which are common, but usually only a nuisance, and can be treated by Chlorpromazine 25 mg IM and if that doesn't work, in 1/2 hour an additional 25 mg IM may be given. If excessive dosage of benzodiazepines have been given, there may be some ataxia and motor dysfunction, including confusion, dysarthria and ataxia, but this should rapidly wear off, or can be reversed by Flumazenil.

Toxicity from local anaesthesia can be divided into two categories: neurological (early) and cardiac (late). In those patients who have not had benzodiazepine cover, large dosages of local anaesthetic may produce the traditional early neurological sensations which are usually expressed as a chilled sensation, shivering, muscle twitching and visual disturbances. Perioral, paraesthesia and numbness, and especially a bitter taste in the mouth are said to be pathognomonic. Later symptoms are larger muscle twitchings and tonic-clonic convulsions followed by CNS depression. Cardiac effects occur much later and represent much more serious local anaesthetic overdose. Bupivacaine is thought to be more cardiovascularly toxic and can cause severe cardiac arrhythmias.

Treatment of local anaesthetic overdose consists of immediate intravenous benzodiazepine, either midazolam 2.5-5 mg or Diazepam 10-15 mg, by slow injection over 1 to 5 minutes, depending upon the urgency. The next step in the treatment of local anaesthetic toxicity is administration of oxygen and hyperventilation. If the patient is conscious, he should be asked to hyperventilate 100% oxygen, or if the patient is unconscious the patient should be intubated and hyperventilated with 100% oxygen with an Ambu Bag. The patient should by now be placed in the Trendelenburg position and an ambulance should be on the way. Should cardiovascular collapse take place, cardiopulmonary resuscitation must be performed. An algorithm should be posted on the wall and each member of the surgical team should know their role in case of such emergency.

EPINEPHRINE/BETA BLOCKER INTERACTION

A serious and life threatening syndrome of severe hypertension with bradycardia has been well documented when Lidocaine with Epinephrine has been administered to patients currently taking beta blockers.² Although extremely rare, it has been very well documented and since it is life threatening, my opinion is, that if at all possible, Lidocaine and Epinephrine should not be given to patients taking beta blockers. If, for whatever reasons it is considered imperative to proceed with surgery involving Adrenaline and beta blockers, this must be done with great caution and in stages, with monitoring equipment and full resuscitative facilities available. Treatment for the Epinephrine/Beta Blocker reaction, includes intravenous administration of Chlorpromazine in 1 mg increments, with careful monitoring. Less than 5 mg is usually necessary. An effective alternative treatment is a Hydralazine drip of 20 mg mixed in 250 ml of normal saline administered slowly IV with monitoring. If bradycardia persists after control of hypertension, the patient can be given Atropine.

ALLERGIC REACTIONS

Allergic reactions to local anaesthetics are extremely rare and mainly associated with the Ester anaesthetics,

such as Procaine (Novocaine). These allergic reactions may be anaphylactic, delayed or urticarial or a mixture of these three types. True allergic reactions to the Amide group of local anaesthetics which include Xylocaine and Bupivacaine are extremely rare. So called allergies to Xylocaine are more often caused by the Paraben preservatives included in the commercial preparations. Anaphylactic reactions which have occurred very rarely, should be treated in the usual manner, with intravenous Epinephrine and Hydrocortisone and a tourniquet placed around the skull.

EPINEPHRINE REACTIONS

Epinephrine reactions are characterized by anxiety, tachycardia and perspiration. They are nearly always self limited and short lasting. One need only consider treatment if the heart rate remains above 140 beats per minute or ventricular arrhythmias occur. In such cases administration of 100 mg bolus of intravenous Lidocaine or intravenous Propranolol should be considered.

SYNCOPE—OR VASOVAGAL ATTACK

This will be one of the more common adverse reactions observed, especially by new hair transplant surgeons. Patients seem to be able to sense inexperience and lack of confidence on the part of a surgeon and surgical team, however experienced the surgeon may be in other branches of surgery. Syncope, unexpectedly, is common in young, physically fit patients, who often have high vagal tone. Syncope is characterized by the patient feeling faint, or having nausea, and appearing pale. The monitor that should be used will demonstrate bradycardia and hypotension. In a fully blown case, the patient may lose consciousness. Occasionally, a syncopal seizure may be the presenting symptom of a vasovagal attack causing syncope resulting in cerebral anoxia: with any seizure though, one should carefully consider the possibility of local anaesthetic toxicity. Treatment consists of putting the patient in the Trendelenburg position, with the legs raised and given oxygen, and usually the patient will very rapidly experience relief. Should the syncope appear prolonged, I would treat them with 0.6 mg of Atropine intravenously, administered slowly.

SUMMARY

If the above described protocol of benzodiazepine sedation, local anaesthesia with Xylocaine and Epinephrine using needleless injectors, with or without EMLA cream, depending upon the degree of sedation, utilizing all the above-mentioned techniques, is followed, even a beginner in hair transplantation can consistently achieve effective local anaesthesia, resulting in "painless" hair transplantation.

REFERENCES

1. Monheit GD: Anaesthesia. In Unger WP, Nordstrom REA, editors: Hair transplantation, ed 2 New York 1988, Marcel Dekker, p 135.
2. Winton GO: Anaesthesia for dermatologic surgery, J Dermatol Surg Oncol 14:1, 1988.