

Hair Transplant Practice Guidelines

Venkatram Mysore, Muthuvel Kumaresan¹, Anil Garg², Aman Dua³, Aniketh Venkatram¹, Kapil Dua³, Mayank Singh⁴, Madura C.⁵, Ram Chandran⁶, Rajendra Singh Rajput⁷, Sandeep Sattur⁸, Sukhbir Singh⁹

The Venkat Center for Skin and Plastic Surgery, Bengaluru, Karnataka, India, ¹Cutis Skin Clinic & Hair Transplant Center, Coimbatore, Tamil Nadu, India, ²Rejuvenate Hair Transplant Center, Indore, Madhya Pradesh, India, ³AK Clinics & Hair Transplant Center, Delhi, India, ⁴Radiance Cosmetic Center, Delhi, India, ⁵Cutis Academy of Cutaneous Sciences, Bangalore, India, ⁶Apollo Speciality Center, Chennai, Tamil Nadu, India, ⁷Rajesh Rajput Clinic, Mumbai, India, ⁸Hair Revive Center, Mumbai, India, ⁹Resplendent Cosmetic Studio, Delhi, India

Abstract

The field of hair transplant (HT) has grown exponentially in the past decade, especially after the introduction of follicular unit excision (FUE). There is much variation in criteria for case selection, the technique, pre- and post-procedure protocols, by different surgeons. Techniques continue to evolve and evidence in the form of controlled data is not available for all techniques and protocols being used; there is also a debate as to who can do what, what should be the training for staff, role of technicians. This has led to a situation wherein medico legal issues have cropped up as to what is minimum acceptable. An attempt is made to summarize standard protocols with the available evidence. It is emphasized that the objective of these guidelines is to recommend minimum standards for practice of hair transplantation. The principles outlined in these guidelines are of a general nature only, minimal in their level and are not meant to cover all situations. It should be understood that these recommendations are by no means binding and universal, represent minimum standards only and as in all surgical techniques, variations in techniques are possible. It is also further clarified that these are based on current literature, and as science evolves, these guidelines could also change in future. Where published evidence is not available, consensus expert opinion is presented. The task force emphasizes that each patient has to be treated on his/her own merit and that these guidelines do not limit the physician from making an appropriate choice or the necessary innovation for a given patient. The task force recognizes that the treating surgeon is best suited to decide what is needed for a given patient in a given situation. Innovations in medicine need flexibility in approach and these guidelines do not limit the surgeon from undertaking innovative research.

Keywords: Guidelines, hair transplant, surgery

Financial support and sponsorship

Association of Hair Restoration Surgeons of India.

Conflicts of interest

There are no conflicts of interest.

HAIR TRANSPLANT PRACTICE GUIDELINES: PART 1

Introduction, Rationale, and Scope for the Guidelines:

The field of hair transplant (HT) has grown exponentially in the past decade, especially after the introduction of follicular unit excision. There is much variation in criteria for case selection, the technique, and pre-procedure and post-procedure protocols, by different surgeons. Techniques continue to evolve and evidence in the form of controlled data is not available for all techniques and

protocols being used; there is also a debate as to who can do what, what should be the training for staff, and the role of technicians. This has led to a situation wherein medicolegal issues have cropped up as to what is minimum acceptable. An attempt is made here to summarize standard protocols with the available evidence.

It is emphasized that the objective of these guidelines is to recommend minimum standards for practice of HT. The principles outlined in these guidelines are of a general

Address for correspondence: Dr. Muthuvel Kumaresan,
Cutis Skin Clinic & Hair Transplant Center, Coimbatore,
Tamil Nadu, India.
E-mail: dr_kumaresh@yahoo.co.in

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Mysore V, Kumaresan M, Garg A, Dua A, Venkatram A, Dua K, *et al.* Hair transplant practice guidelines. *J Cutan Aesthet Surg* 2021;14:265-84.

Access this article online

Quick Response Code:



Website:
www.jcasonline.com

DOI:
10.4103/JCAS.JCAS_104_20

nature only, minimal in their level and are not meant to cover all situations. It should be understood that these recommendations are by no means binding and universal, represent minimum standards only and as in all surgical techniques, variations in techniques are possible. It is also further clarified that these are based on current literature, and as science evolves, these guidelines could also change in future. Where published evidence is not available, consensus expert opinion is presented.

The taskforce emphasizes that each patient has to be treated on his/her own merit and that these guidelines do not limit the physician from making an appropriate choice or the necessary innovation for a given patient. The taskforce recognizes that the treating surgeon is best suited to decide what is needed for a given patient in a given situation. Innovations in medicine need flexibility in approach and these guidelines do not limit the surgeon from undertaking innovative research.

EVIDENCE LEVELS AND LEVELS OF RECOMMENDATION

The taskforce used a modified Harbour and Miller's revised grading system for recommendations in formulating these guidelines.

Levels of evidence

- 1 Meta-analyses, systematic reviews of randomized control trials (RCTs)
- 2 One or more case-control or cohort studies of high quality
- 3 Nonanalytic studies, for example, case reports and case series
- 4 Expert opinion

Grades of recommendations

- A. Strongly recommended on the basis of at least one meta-analysis, systematic review, or RCT rated as 1 and likely to be relevant in future also
- B. Recommended on the basis of studies rated as 2 and demonstrating overall consistency of results or extrapolated evidence from studies rated as 1; and may change in future subject to future developments
- C. Recommended for use based on current use, not sufficiently corroborated, based on evidence rated as 2 or 3, and likely for subsequent change
- D. Based on insufficient evidence rated as level 3 or 4 and needs further evidence.

REFERENCE

1. Harbour R, Miller J. A new system for grading recommendations in evidence based guidelines. *BMJ* 2001;323:334-6.

PHYSICIAN QUALIFICATIONS, ROLE OF TECHNICIANS, AND TRAINING OF DOCTORS AND STAFF

Hair transplant surgeons:

There is no uniform opinion as to which specialties can perform HT. Even medical councils have not categorically resolved this issue, and different associations have different criteria for membership.

In October 2015, the Association of Hair Restoration Surgeons – India (AHRS-I) resolved that the only specialties eligible to become members of AHRS-I and practice HT surgery would be,

The Master of Plastic Surgery (MCh)/DNB Plastic Surgery

Doctor of Medicine or postgraduate in Dermatology

Master of Surgery (MS) or postgraduate in Ear, Nose, and Throat (ENT) surgery

MS General Surgery (MS)

Modern medical practitioners (MBBS doctors/specialists not included in the qualifications just cited) who have passed the American Board of Hair Restoration Surgery (ABHRS) exam are also eligible to perform HT surgery.

Disclaimer

The eligibility to do HT should be governed by the regulations of the state and/or national medical council.

This taskforce is of the opinion that Ayurvedic doctors, homeopathic doctors, and dentists are not qualified to perform HT surgery.

Any procedure that involves tissue removal from the scalp or body, by any means, should be performed by a licensed physician in the field of medicine. The taskforce recommends that the following aspects of hair restoration surgery should only be performed by a qualified HT surgeon and not by technicians:

- Preoperative diagnostic evaluation and consultation
- Surgery planning
- Surgery execution, including:

Donor hair harvesting

Hairline design

Recipient site creation

- Management of other patient medical issues and possible adverse reactions
- Postoperative care

The concept of nonphysicians removing human tissue and primarily performing HT surgery is improper and not acceptable. It is not consistent with the standard of care in the medical community.

ROLE OF ASSISTANTS (TECHNICIANS)

HT practice needs assistants, who are also called HT technicians; it is both ethical and necessary that such assistants are from a medical background, such as nurses, lab technicians, pharmacists, and MBBS doctors. However, they need to be provided structured, systematic, and proper training in aspects of both HT and disinfection, sterilization, patient communication etc. However, unrelated nonmedical personnel such as arts graduates, industrial training institute technicians should not be used as they have little understanding of sterilization and cannot handle any medical emergency that may arise during the procedure.

Technicians can be involved only in the following steps of the HT surgery:

- (a) Picking up the grafts (extraction) after scoring
- (b) Arranging the grafts
- (c) Implantation into premade slits
- (d) Postoperative dressings

Surgical assistants/technicians should perform tasks only under the supervision of a physician and they are allowed to perform only those steps that do not involve an incision of the body. Hence, they should not perform scoring (incision), slit making, and suturing. The assistants should be offered training on models initially, then placed as observers for the surgical process, and finally be deputed for the HT surgery. At least one of the assistants should be a paramedical staff and trained in Basic Life Support/advanced cardiac life support.

Level of Evidence: 4

Grades of Recommendation: D

REFERENCES

1. Kumaresan M, Mysore V. Controversies in hair transplantation. *J Cutan Aesthet Surg* 2018;11:173-81.
2. ISHRS.org [Internet]. Geneva, IL, USA: International Society of Hair Restoration Surgery, Inc.; c1993 [updated 2019 March 19]. Available from: <http://www.ishrs.org/>. [Last accessed on 2019 Aug 18].
3. AHRINDIA.orgcapitals pls (Internet) Ludhiana Association of Hair Restoration Surgeons – India. Inc; c2011 (updated 2015 March 10). Available from: <http://www.ahrsindia.org/>. [Last accessed on 2019 Aug 18].
4. Williams KL Jr. Current practices and controversies in cosmetic hair restoration. *Dermatol Surg* 2013;39:797-801.

TRAINING

Physicians who perform HT surgery must possess the education, training, and current competency in the field of hair restoration surgery. Membership in the national hair restoration society/global society and regular attendance at annual conferences and workshops facilitate the education and training. Fellowship courses from the International Society of Hair Restoration Surgery (ISHRS) would be an added qualification.

It is further observed that HT is not taught as a subject in any of the earlier cited courses that were listed as the eligibility criteria for an HT surgeon. Although the surgical specialties such as Mch/DNB plastic surgery, MS general surgery, and MS ENT provide an adequate surgical background, training in trichology is lacking. Likewise, MD/DNB/Diploma in Dermatology provides adequate training in trichology, but surgical training is lacking.

In view of this, this taskforce recommends that:

1. Mch/DNB plastic surgery, MS general surgery, and MS ENT doctors should undergo further training in trichology in a clinic that provides such training under a dermatologist/HT surgeon, preferably for three months, but at least for a period of 1 month.
2. Likewise, MD/DNB/Diploma in Dermatology doctors should undergo adequate training (both hands on and observational) under the supervision of an experienced HT surgeon. Although no legal guideline exists to define how much observation and supervision is needed, this taskforce recommends that at least 50 surgeries be observed and 25 surgeries be performed under supervision before starting independent practice. This training should also include training in basic surgical practices, sterilization, disinfection, and emergency resuscitation.

The taskforce is of the firm opinion that watching in workshops or on YouTube is not adequate training to start HT practice and strongly condemns and discourages such training.

Level of Evidence: 4

Grades of Recommendation: D

REFERENCE

1. ISHRS.org [Internet]. Geneva, IL, USA: International Society of Hair Restoration Surgery, Inc.; c1993 [updated 2019 March 19; cited 2019 August 18]. Available from: <http://www.ishrs.org/>.

ETHICAL ISSUES

The use of trademarks or service marks as commercial names for a hair restoration procedure, without disclosing the scientific basis for the procedure, its complications and side effects is not in the public interest. Nor is it in the public interest to use a commercial name to market a procedure that is described under a commonly accepted name in the medical literature, without revealing the name used in the medical literature. Professional disagreements should be aired in a forum of peers. Denigration that aims at destroying another physician's practice is morally reprehensible. Physicians who market their services have a responsibility for "truth in advertising."

The following advertisements are considered to be misleading the public:

1. Inaccurate Credentials. Incorrectly claiming to be certified by the AHRS-I, ABHRS or claiming to be a member or Fellow of the ISHRS, and otherwise stating or suggesting any expertise in hair restoration surgery that is false.
2. Misrepresenting Board Certification. Physicians should identify their specific medical specialty certifying board when marketing their board certification in the public domain language, such as “board certified hair restoration surgeon” is not acceptable.
3. Misrepresenting Photographs. Publishing photographs of other physicians’ patients in any manner that states or suggests that they are patients of the publishing practice.
4. Copyright/Trademark Violations in General. Republishing or otherwise representing the photographs, publications, trade names, logos, or other trademarks of another practitioner without permission in violation of the owner’s copyrights and/or trademarks.
5. Misleading Language. Use of the following terms and phrases in marketing by a hair restoration surgeon may mislead the public:

“Scarless surgery”

“No incision”

“No touch”

“No cutting”

“Cloning”

“Hair multiplication”

“Non-invasive”

“Eliminates the need for additional procedures”

“Pain free or no pain”

“Unlimited grafts”

“Guaranteed results”

Level of Evidence: 4

Grades of Recommendation: D

REFERENCE

1. ISHRS.org [Internet]. Geneva, IL, USA: International Society of Hair Restoration Surgery, Inc.; c1993 [updated 2019 March19; cited 2019 August 18]. Available from: <http://www.ishrs.org/>.

CHARGES FOR THE SURGERY

The surgery cost should be based on the number of follicular units/follicles/package for a particular surface area as per the surgeon’s routine pricing practice. However, each term unit/graft/follicle should be explained and the patient should be familiar with the terminology.

Costs should be informed beforehand to the patient and documented in the consent form.

TRANSPARENCY

Transparency in the HT surgery should be followed in the following aspects:

- The physician who will be performing the surgery and the role of assistants should be informed to the patient prior to the surgery.
- The role of the surgeon and the role of assistants should be documented – who does what
- Hairline design, once accepted by the patient and the surgeon, should be documented with an image.
- Number of grafts/ follicles/ area to be covered initially planned and actually performed should be disclosed to the patient and documented with images. The discharge slips should document the number of units of each type, 1/2/3/4 hairs total; number of units; and total number of hair separately.
- Provision of counting the grafts can be explained to the patient.
- The need for the medical management/chances of inadequate growth/ thinning of grafted follicles with time post-HT should be discussed with the patient and documented.
- Charging for the surgery should be only for viable follicles that are transplanted.

Level of Evidence: 4

Grades of Recommendation: D

DOCUMENTATION AND CONSENT

A medical record is admissible as documentary evidence in a legal suit. So it is important to maintain a meticulous record of clinical details of the patient, the counseling process, consent taking, detailed preoperative, operative, and postoperative notes and instructions, and follow-up visits.

Preoperative documentation should include the details about any preexisting health issues, drug allergy, photograph id lignocaine test dose, baseline vital parameters, hairline design planned, planned number of grafts to be harvested, expected results with duration, donor adequacy, continuation of medical management if required, and the possibility of a second surgery after a particular period.

Intraoperative records should include the vital parameters, drugs administered and their dosage, complications if any and the remedial measures that were carried out, number of grafts planted, the area of scalp covered the details of the surgical team, and the duration of the surgery with the timings of the beginning and the end of each stage of the surgery.

Immediate postoperative records should have the following details: vital parameters after the surgery, duration of observation post-surgery, complications if any at the end of the surgery, remedial measures taken, postoperative prescription and advice, emergency contact number for communication, and the details of the follow-up visit.

The patient's failure to adhere to post-procedure consultations, neglect of precautions, and noncompliance of instructions, if any, should also find place in the record.

Both manual signed records and computerized data help in the standardization, storage, and easy retrieval of records.

Photographs taken before, during, and after the procedure provide adequate proof of the outcome of the procedure.

Medical records of HT must be preserved for five years, but those pertaining to malpractice suits must be preserved till the final settlement of the case.

The aesthetic surgeon or the hospital is vested with the custodial ownership of records. However, on request, these should be provided to the patient within 72 h.

The Consumer Protection Act can condone a delay in filing a case of negligence beyond the prescribed limitation of two years from the date of occurrence.

Consent in the medical field can be defined as an instrument of mutual communication between a doctor and a patient with an expression of authorization/permission/choice by the latter for the doctor to act/not act in a particular way.

Lack of informed consent is a frequent cause of allegations of medical negligence.

Consent should have the following details:

Procedure details in a language that the patient understands

Risks involved

Complications that can arise

Outcome expected

Duration of treatment (average)

Expenses involved (approximate)

Evidence Level: 3

Category of recommendation: C

REFERENCES

1. Akshay GN, Aparna S. Clinical photography for periorbital and facial aesthetic practice. *J Cutan Aesthet Surg* 2016;9:115-21.
2. Khavkin J, Ellis DA. Standardized photography for skin surface. *Facial Plast Surg Clin North Am* 2011;19:241-6.
3. Galdino GM, DaSilva And D, Gunter JP. Digital photography for rhinoplasty. *Plast Reconstr Surg* 2002;109:1421-34.

4. Shah AR, Dayan SH, Hamilton GS 3rd. Pitfalls of photography for facial resurfacing and rejuvenation procedures. *Facial Plast Surg* 2005;21:154-61.
5. Satish M, Menon R, Rao KV. Professional accountability and patients' rights, 2nd ed. Bengaluru: The Institute of Law and Ethics in Medicine, National Law School of India University; 2002. p. 57-68.
6. Indian Medical Council. Indian medical council (professional conduct, etiquette and ethics) regulations. 2002 (published in gazette of India, o.14, part III section4 dated 6.4.2002. New Delhi: Indian medical council; 2002.
7. Mousavi SR. The ethics of aesthetic surgery. *J Cutan Aesthet Surg* 2010;3:38-40.
8. Bastia BK, Kuruvilla A, Saralaya KM. Validity of consent – A review of statutes. *Indian J Med Sci* 2005;59:74-8.
9. Stayanarayan Rao KH. Informed consent: An ethical obligation or legal compulsion? *J Cutan Aesthet Surg* 2008;1:33-5.
10. Beauchamp TL, Childress JF. Fair opportunity. In: Haker H, Beylvelid D, editors. *Principle of biomedical ethics*. 5th ed. Oxford: Ashgate Publishing Co; Oxford University Press; 2001. p. 335.
11. Trehan SP, Sankhari D. Medical professional, patient and the law: the institute of law and ethics in medicine. 2nd ed. Bangalore: National Law School of India University; 2002. pp. 57-68.
12. Kohli A. Medical consent in India – Ethical and legal issues. *Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicity* 2007;8:8-9.
13. Mavroforou A, Giannoukas A, Michalodimitrakis E. Medical litigation in cosmetic plastic surgery. *Med Law* 2004;23:479-88.

COUNSELING FOR THE MEDICAL MANAGEMENT

HT surgery should not be considered as a single-step permanent solution for androgenetic alopecia (AGA), since the hair loss in AGA is a continuous process. The taskforce recommends that every patient should be educated about the importance of continuing the medical management even after the HT surgery. Topical minoxidil 2–5% and oral finasteride at a dosage of 1 mg/day are the approved medications for AGA. Dosage and duration should be individualized according to the degree of hair loss.

Level of Evidence: 1

Grades of Recommendation: A

REFERENCES

1. Mysore V, Parthasaradhi A, Kharkar RD, Ghoshal AK, Ganjoo A, Ravichandran G, *et al.* Expert consensus on the management of androgenetic alopecia in India. *Int J Trichology* 2019;11:101-6.
2. Blumeyer A, Tosti A, Messenger A, Reygagne P, Del Marmol V, Spuls PI, *et al.*; European Dermatology Forum (EDF). Evidence-based (S3) guideline for the treatment of androgenetic alopecia in women and in men. *J Dtsch Dermatol Ges* 2011;9 Suppl 6:S1-57.

HT PRACTICE GUIDELINES: PART 2

Introduction

HT surgery is considered as a daycare surgery that does not require in-hospital admission. However, similar to all surgical treatments, maintaining standards of care is of utmost importance. This part of the guidelines describes the minimum standard of care in establishing a setup for HT surgery, sterilization process, preoperative workup, case selection, and antimicrobial prophylaxis.

General safety

It is recommended that any practice performing office-based surgery regardless of anesthesia will have the necessary equipment, protocol, and personnel to handle emergencies resulting from the procedure, anesthesia, and the other environmental emergencies. As per the Clinical Establishment Act of the respective state authority, all applicable safety measures as per local law should be adopted.

Operating room

Although HT is a simple minimally invasive surgery, all protocols should be followed to see that adequate asepsis, sterilization, disinfection, and resuscitation are in place. The surgery should not be taken lightly and the taskforce strongly disapproves the usage of temporary theaters such as consultation rooms, minor procedure rooms, spa rooms, etc. for performing HT. At least one of the nurses should be an operation theater (OT) trained nurse.

The HT operating room can be located in a multispecialty hospital, a private clinic, or in shared spaces of polyclinics. The operating room should be located in a restricted zone where hair cover, face mask, surgical attire, and slippers for both patient and doctor are required.

The taskforce would like to recommend the minimum size of the HT operating room to be 12 x 12 feet with a height of the room to be a minimum of 10 feet. An additional dissecting room of equal size is needed, particularly for FUT surgeries. Alternately, a larger OT of 20 x 12 feet can include both OT and dissecting room. This criterion of minimum space in the operating room includes the space to move around the operating table in case of emergency resuscitation. The door should be preferably of width more than 24 inches and should lead to adequate space for the trolley/stretchers to be taken out, in case of emergencies. The floors should be impervious to moisture, easy to clean, stain resistant, and suitable for wheeled traffic. Windows, if present, should be sealed and protected to maintain strict asepsis.

Provision for a preparatory room to change slippers and a dress change room, for both patient and staff, should be planned. A dressing/washing area should include a washbasin provided with a hand disinfectant dispenser and a tap with a long handle.

Level of Evidence: 2

Grade of Recommendation: B

REFERENCES

1. Malkin J. Ambulatory surgical centers. In: Malkin J, editor. Medical and Dental Space planning, A comprehensive guide to design, equipment and clinical procedures. 3rd ed. New York: John Wiley and Sons; 2002. p. 334-6.
2. Asadi KA, Goldberg LH, Peterson SR, Silapint S, Jih MH. The incidence of major complications from Mohs micrographic surgery performed in office-based and hospital based settings. *J Am Acad Dermatol* 2005;53:628-34.

3. Malkin J. Ambulatory surgical centers. In: Malkin J, editor. Medical and Dental Space planning, A comprehensive guide to design, equipment and clinical procedures. 3rd ed. New York: John Wiley and sons, Inc; 2002. p. 352-3.
4. Drake LA, Ceilley RI, Cornelison RL, Dinehart SM, Dorner W, Goltz RW, *et al.* Guidelines of care for office surgical facilities. *J Am Acad Dermatol* 1992;26:763-5.
5. Savant SS, Gore D. Instruments, equipment and universal precautions. In: Savant SS, editor. Textbook of dermatosurgery and cosmetology. 2nd ed. Mumbai: Association of Scientific Cosmetologists and Dermatologists; 2005. p. 26-34.
6. Lawrence C. Equipment. In: Lawrence C, editor. An introduction to dermatological surgery. 2nd ed. London: Churchill Livingstone; 2002. p. 5-6.
7. Rajendran SC, Omprakash HM. Standard guidelines for setting up a dermatosurgery theatre. *Ind J Dermatol Venerol* 2009;75:76-82.

LIGHTING

General lighting in the theater by a fluorescent lamp-mounted flush with the ceiling is adequate.

- Fluorescent lamp: at the rate of 1 W per square foot (i.e., for 120 square feet – 120W – three tubes of 40W). Ceiling or pedestal lighting of the operation field.
- Shadowless lighting delivering 3,000–8,000 foot candles (i.e., the dental chairs have a halogen lamp of 50 W power. Each Watt of power will give 50 foot candles of illumination at the site of surgery. So 50 W of a halogen bulb can roughly give 2,500 foot candles of illumination at the site of surgery)
- It is important that heat generation by the lighting system is kept to minimum.

REFERENCES

1. Rajendran SC, Omprakash HM. Standard guidelines for setting up a dermatosurgery theatre. *Ind J Dermatol Venerol* 2009;75:76-82.
2. Malkin J. Ambulatory surgical centers. In: Malkin J, editor. Medical and Dental Space planning, A comprehensive guide to design, equipment and clinical procedures. 3rd ed. New York: John Wiley and Sons; 2002. p. 334-67.

Alternately, surgeons have used lights attached to loupes, which is also adequate.

Grade of recommendation: C

Level of Evidence: 3

STERILIZATION AND DISINFECTION OF OPERATION THEATER AND INSTRUMENTS

- The operation table, chair, light, shelves, and sink should be wet mopped daily free of dust, with water and the use of a broom should be avoided. Chemical disinfectant is recommended for the floor. The wet mop used should be left in a proper place to dry.
- The OT trolley should be mopped with a chemical disinfectant or isopropyl alcohol before surgery and

between two surgeries.

- The floor and other areas of blood spillage should be mopped with a chemical disinfectant. The operating room wall and ceiling need to be cleaned periodically.
- The use of a fan in the OT should be avoided, as it causes aerosolization of dust.
- Regular maintenance of the air conditioner is necessary. The tonnage of air conditioner depends on the size of the room to ensure adequate cooling.
- After an HT surgery, the instruments should be rinsed in 0.5% chlorine for 10 min and then should be washed in water and scrubbed with a brush before sending them for sterilization.
- Linen, draped, gowns: Should be washed with a detergent at 71 degrees for 25 min, and then sent for sterilization.

FUMIGATION

Formaldehyde fumigation can be done initially during a start-up of the theater or after an overhaul cleaning process. Formaldehyde 6%, glutaraldehyde 6%, and benzalkonium chloride 5% can be used by adequate trained personnel wearing appropriate protective devices. A combination of stabilized hydrogen peroxide 11% w/v and diluted silver nitrate solution 0.01% w/v is an ideal aerial disinfectant and OT fumigant acting as a sterilant at a recommended concentration of 20% at 1h contact time. Fumigation should be done daily or prior to each surgery.

In between two operative procedures on the same day, spot cleaning of operation tables, theater equipment with disinfectant solution is recommended. In case of spillage of blood/body fluids, decontamination with bleaching powder/chlorine solution should be done. Fumigation should be repeated prior to the second surgery, if performed on the same day.

AUTOCLAVE

- All material should be dried and wrapped in cloth or medical grade paper.
- The instruments should be laid so that all surfaces come in contact with heat.
- Time depends on individual recommendations, but it is usually 121 degrees for 15 min.

Chemical sterilization of instruments:

- Cleaned, disinfected, and dried instruments should be fully soaked in a steel or plastic container having 2% glutaraldehyde for 8–10 h.
- After 10h, using autoclaved water (100mL of water autoclaved for 20min and not boiled water) the instruments should be washed, dried, packed, and stored in a sterile tray. Note that the contact time for

high-level disinfection is just 20 min compared with the 10h required for sterilization.

Sterilization of follicular unit excision machines and implanters:

Heat- and moisture-sensitive electronic goods and other implanters are sterilized using ethylene oxide sterilization.

REFERENCES

1. Patwardhan N, Kelkar U. Disinfection, sterilization and operation theater guidelines for dermatosurgical practitioners. *IndJ Dermatol Venereol Leprol* 2011;77:83-93.
2. Mysore V, Anitha B. Checklists for surgical safety in dermatosurgery. *J Cutan Aesthet Surg* 2009;2:1-3.
3. Rutala WA, Weber DJ. Chemical disinfection of medical and surgical materials. In: Block SS, editor. *Disinfection, sterilization and preservation*. 3rd ed. Philadelphia: Lea and Febiger; 1983. p. 469-92.
4. Kelkar U, Bal AM, Kulkarni S. Monitoring of steam sterilization process by biologic indicators – a necessary surveillance tool. *Am J Infect Control* 2004;32:512-3.
5. Simpson RA, Slack RC. Sterilization and disinfection. In: Greenwood D, Slack RC, Peutherer JF, editors. *Medical Microbiology*. 16 th ed. London: Churchill Livingstone; 2002. p. 73-82.
6. Govindaraj S, Muthuraman MS. Systematic review on sterilization methods of implants and medical devices. *Int J Chem Tech Res* 2015;8:897-911.
7. Gupta C, Vanathi M, Tandon R. Current concepts in operative room sterilisation. *J Ophthalmol* 2015;25:190-4.

Grade of recommendation: C

Level of Evidence: 3

BIOMEDICAL WASTE MANAGEMENT

- Segregation, collection, transportation, storage, and disposal of biomedical waste should be as per biomedical waste handling rules, and that of general waste should be as per applicable local laws.

Grade of recommendation: D

Level of Evidence: 4

PREOPERATIVE CONSIDERATIONS

A detailed preoperative evaluation of the patient's medical status is essential. It is recommended to get the patient assessed opined upon by a treating doctor or an independent physician regarding the patient's eligibility to undergo HT.

REFERENCES

1. Ellsworth WA, Basu B, Iverson RE. Perioperative considerations for patient safety during cosmetic surgery - preventing complications. *Can J Plast Surg* 2009 Spring;17:9-16.
2. Unger WP. The initial interview and evaluation. In: Unger WP, Shapiro R, Unger R, Unger M, editors. *Hair transplantation*. 5th ed. Boca Raton, FL: CRC Press; 2011.
3. Unger WP. The preoperative phase. In: Unger WP, Shapiro R, Unger R, Unger M, editors. *Hair transplantation*. 5th ed. Boca Raton, FL: CRC Press; 2011.

CASE SELECTION WITH RESPECT TO AGE

Age is an important, but not the only consideration for case selection. Since AGA is a continuous and progressive condition, early surgery would lead to future hairloss negating the results of surgery and causing an ugly recession that can affect the patient psychologically. Further, younger individuals cannot be relied upon to adhere to long-term drug therapy. Younger individuals are also likely to have unrealistic expectations and often expect a cure of AGA by HT. For these reasons, HT in the early age group is not recommended and it is preferable to wait till at least 23–25 years of age. It is also preferable to treat such patients with medical management for a few months, develop rapport, and then decide for surgery.

However, there are some special situations where early surgery may be necessary in patients who are between 21 and 23 years of age:

1. Advanced hair loss Hamilton–Norwood stages 4–6, which causes severe psychological issues and where drug therapy is unlikely to be beneficial.
2. Young patients in special professions such as acting, media, modeling, etc, whose career gets affected by postponing surgery.
3. Patients who are severely psychologically affected by their baldness.
4. In cases of tractional alopecia, secondary cicatricial alopecias (burns, trauma, surgical scars over hair-bearing regions).

In all these cases, extensive counseling over several sessions, preferably in the presence of their parents, is advocated. This taskforce does not recommend surgery in those younger than 21 years of age.

Level of Evidence: 4

Grades of Recommendation: D

REFERENCE

1. Unger WP. Preoperative preparations and instructions. In: Unger WP, Shapiro R, Unger R, Unger M, editors. Hair transplantation. 5th ed. New York: Informa Health Care; 2011. pp. 198-226.
2. Patwardhan N, Kirane V. Case selection, counseling and planning for the surgery. In: Mysore V, editor. Hair transplantation. 1st ed. New Delhi: Jaypee Brothers Medical Publishers (p) Ltd; 2016. pp. 119-24.

PREOPERATIVE INSTRUCTIONS

The expert committee recommends the following instructions before the HT surgery: Allergies to any medications in the past, history of previous surgeries, complications if any, and the medications currently being consumed by the patient should be documented in the case sheet. Medications for hypertension, epilepsy, thyroid, and diabetes should be continued, if any, as per the treating physician's recommendation and medical clearance from the physician is recommended for those with history of any

cardiac surgeries or cardiac procedures. Specific instructions as per the operating surgeon need to be followed.

Preoperative check list:

1. Minoxidil to be stopped one week prior to the procedure, as it may increase bleeding.
2. Alcohol to be avoided seven days before and after the procedure.
3. Smoking should be reduced as much as possible before the surgery and it would be safe to stop it entirely.
4. Preoperative tranquilizer in an anxious patient.
5. NSAIDS to be restricted 12–24 h before the surgery.
6. Antihypertensives to be continued on the day of the surgery. Beta-blockers to be avoided on the day of the surgery.
7. Vitamin supplements and herbal preparations to be avoided for three weeks before the surgery.
8. Lignocaine test dose for sensitivity, preferably one day prior to the surgery to account for delayed allergic reaction to the local anesthetics.
9. Preoperative photographs: standard positions.

Front facial, chin to chest, right oblique, left oblique, and vertex view

Level of Evidence: 4

Grades of Recommendation: D

REFERENCES

1. Patwardhan N, Mysore V; IADVL Dermatosurgery Task Force. Hair transplantation: Standard guidelines of care. Indian J Dermatol Venereol Leprol 2008;74 Suppl:S46-53.
2. Unger WP. Preoperative preparations and instructions. In: Unger WP, Shapiro R, Unger R, Unger M, editors. Hair transplantation. 5th ed. New York: Informa Health Care; 2011. pp. 198-226.

PREOPERATIVE LABORATORY WORKUP

Preoperative laboratory studies to be performed in all age groups include Hb%, blood counts including platelet count, bleeding and clotting time (or prothrombin time and activated partial thromboplastin time), venereal disease research laboratory, ECG, fasting blood sugar, antibodies for hepatitis B and C surface antigen, and HIV screening tests.

INVESTIGATIONS IN SPECIAL SITUATIONS

Electrocardiography

Routine electrocardiography is not recommended routinely before HT surgery; however, it is advisable to perform it in the following circumstances:

In a patient with any present or past cardiac symptom (including breathlessness, pre-syncope, syncope, or chest pain) or history of cardiac disease or obesity or metabolic syndrome.

Patients with abnormal ECG are recommended to get a cardiologist's opinion before the surgery.

PREOPERATIVE EVALUATION IN HYPERTENSIVES

In patients with hypertension undergoing surgery, it is recommended to continue most antihypertensive medications until surgery, including the morning of the surgery. Medical fitness for HT surgery should be obtained from the physician. Intraoperative management of hypertension should be done in association with the anesthetist.

EVALUATION IN DIABETICS

A preoperative assessment should be done with support from a diabetologist/endocrinologist. It should occur sufficiently in advance of the planned surgery to ensure optimization of glycemic control as per the recommendation of the treating physician for the particular patient, before the date of the proposed surgery. People with diabetes should have their most recent HbA1c test results analyzed. HbA1c testing should be offered to people with diabetes having surgery if they have not been tested in the past three months. With appropriate guidance, patients with diabetes should be allowed to retain control and possession of, and continue to self-administer, their medication. The aim is to avoid hypoglycemia or hyperglycemia during the period of fasting and the time during and after the procedure, until the patient is eating and drinking normally.

Routine HbA1c testing before surgery to people without diagnosed diabetes is not essential.

Level of Evidence: 4

Grades of Recommendation: D

REFERENCES

1. Patwardhan N, Mysore V; IADVL Dermatotomy Task Force. Hair transplantation: Standard guidelines of care. *Indian J Dermatol Venereol Leprol* 2008;74 Suppl:S46-53.
2. Unger WP. Preoperative preparations and instructions. In: Unger WP, Shapiro R, Unger R, Unger M, editors. *Hair transplantation*. 5th ed. New York: Informa Health Care; 2011. pp. 198-226.
3. National Guideline Centre (UK). Preoperative tests (update): Routine preoperative tests for elective surgery. London: National Institute for Health and Care Excellence (UK); 2016.
4. Hazzi R, Mayock R. Perioperative management of hypertension. *J Xiangya Med* 2018;3:25-35.
5. Membership of the Working Party, Barker P, Creasey PE, Dhataria K, Levy N, Lipp A, Nathanson MH, *et al.* Peri-operative management of the surgical patient with diabetes 2015. *Anaesthesia: Association of Anaesthetists of Great Britain and Ireland*; 2015. 70. pp. 1427-40.

PRE-OP DRUG THERAPY BLOOD THINNERS

HT surgery is a cosmetic surgery and those patients who are on blood thinners and undergoing HT surgery might have the following issues:

1. Issues in donor area: Increased bleeding during and after surgery.

2. Issues in recipient area: Bleeding during implantation and postoperatively leading to popping, displacement, and poor results affecting the outcome.

These patients also may have underlying cardiac conditions that may necessitate avoidance of adrenaline. This will be an additional challenge as it increases bleeding and also leads to shorter action of lignocaine, needing additional doses of lignocaine, with the possibility of cardiac side effects by lignocaine overdose. Bupivacaine also needs careful consideration in such patients because of its cardiac effects.

However, blood thinners are lifesaving and hence cannot be stopped casually, that too for a cosmetic surgery. Any decision to perform surgery in such patients, therefore, needs a careful assessment of risk versus benefit and is subject to clearance by a cardiologist/physician. Management of the antiplatelets and anticoagulants should be carried out as per the advice of the concerned physician. The presence of an anesthetist is mandatory during the procedure in such patients.

Level of Evidence: 4

Grades of Recommendation: D

REFERENCES

1. Unger WP. Preoperative preparations and instructions. In: Unger WP, Shapiro R, Unger R, Unger M, editors. *Hair transplantation*. 5th ed. New York: Informa Health Care; 2011. pp. 198-226.
2. Practice Guidelines for Perioperative Blood Management. An updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management. *Anesthesiology* 2015;122:241-75.
3. Yagyu K. Guidelines for perioperative antithrombotic therapy in hair restoration surgery: Management of patients with coronary heart disease, mechanical heart valve, and atrial fibrillation. *Hair Transplant Forum Int* 2012;22:59-6.
4. Vaishalee K, Aniketh V. Antithrombotic therapy. In: Mysore V, editor. *Hair transplantation*. 1st ed. New Delhi, India: Jaypee; 2016. pp. 132-34.

PREMEDICATION

The primary aim of premedication is to relieve the patient's anxiety/restlessness before anesthesia and to ensure optimum quantity and quality of sleep on the night preceding surgery. With these objectives in mind, oral benzodiazepines are the preferred choice. The taskforce recommends the use of Alprazolam at a dose of 0.5 mg.

Level of evidence: 3

Category of recommendation: C

REFERENCES

1. Unger WP. The initial interview and evaluation. In: Unger WP, Shapiro R, Unger R, Unger M, editors. *Hair transplantation*. 5th ed. Boca Raton, FL: CRC Press; 2011.
2. Unger WP. The Preoperative phase. In: Unger WP, Shapiro R, Unger R, Unger M, editors. *Hair transplantation*. 5th ed. 2011.

- Kim D, Lee S, Pyeon T, Jeong S. Use of triazolam and alprazolam as premedication for general anesthesia. *Korean J Anesthesiol* 2015;68:346-51.
- De Witte JL, Alegret C, Sessler DI, Cammu G. Preoperative alprazolam reduces anxiety in ambulatory surgery patients: A comparison with oral midazolam. *Anesth Analg* 2002;95:1601-6, table of contents.

ANTIMICROBIAL PROPHYLAXIS

HT is categorized as a clean procedure; the taskforce recommends the administration of antimicrobial prophylaxis with cephalosporins since cephalosporins 1h preoperative administration is the most commonly used antibiotic for prophylaxis, apart from Cephadroxil 500mg one tablet during the night before the surgery, one tablet on the morning of the surgery (before the surgery), and one tablet during the night after the surgery. A full course of five days of antibiotics should be administered in cases of surgery over the facial region. If the patient gives a history of sensitivity to penicillin, then an antibiotic from the macrolide group or Clindamycin can be used. Optimum serum and tissue levels must be reached prior to incision and maintained throughout the procedure and only for a few hours post-op.

Level of evidence: 3

Category of recommendation: C

REFERENCES

- Tsilosani A, Gugava M. Is there a rationale for use of antibiotics in hair transplantation surgery? *Georgian Med News* 2005;122:7-10.
- Farjo N. Infection control and policy development in hair restoration. *Hair Transplant Forum Int* 2008;18:141-4.
- Unger WP. Hair transplantation. 4th ed. New York: Marcel Dekker; 1995. pp. 363-74.
- Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital infection control practices advisory committee. *Infect Control Hosp Epidemiol* 1999;20:250-78; quiz 279-80.
- Khichy S, Singh B, Singh M, Singh S. To compare the effectiveness of short-term three dose perioperative antibiotic coverage during decisive period with conventional prolonged postoperative antibiotic usage in clean elective surgical cases: An Indian perspective. *Niger J Surg* 2017;23:92-7.
- Lamont P. Surgical infection. In: Williams NS, Bulstrode CJ, O'Connell PR, editors. *Bailey and Love's short practice of surgery*. 26th ed. Boca Raton, FL: CRC Press; 2013. pp. 50-67.
- Kerk SK, Lai HY, Sze SK, Ng KW, Schmidtchen A, Adav SS. Bacteria display differential growth and adhesion characteristics on human hair shafts. *Front Microbiol* 2018;9:2145.

ANTISEPTIC PROPHYLAXIS

Proper cleansing of the surgical areas (scalp, beard, torso, etc.) before surgery helps in reducing colony counts of the local bacteria. It is recommended to advise the patients to shower or bathe (full body) with soap (antimicrobial or non-antimicrobial) or an antiseptic agent plus shampoo (Povidone iodine + Shampoo) on the night before and on the morning of the operative day.

Level of evidence: 4

Category of recommendation: D

REFERENCES

- Unger WP. The Preoperative phase. In: Unger WP, Shapiro R, Unger R, Unger M, editors. *Hair transplantation*. 5th ed. 2011.
- Farjo N. Infection control and policy development in hair restoration. *Hair Transplant Forum Int* 2008;18.

HT PRACTICE GUIDELINES: PART 3

Anesthesia, resuscitation, and emergency preparedness

Introduction

HT surgery is a daycare surgery that is performed under local anesthesia (LA). An emergency situation in HT surgery, although rare, may arise. This part of the guidelines recommends the minimum standard of care in LA administration, emergency preparedness, and treatment of an emergency situation.

Anesthesia for hair transplantation

It is recommended that the medications and solution be labeled, and the labels should include the following: medication or solution name – strength, diluent name, and volume (if not apparent from the container) that have been verified both verbally and visually by two individuals of the HT team.

As the procedure involves anesthesia being delivered in a stepwise manner and not at one time, the dosage of the medication and the time of administration should be documented and the details can be displayed on a board nearby and visible to the surgeon.

Allergy testing for local anesthesia

In preoperative screening, it is recommended to ask the patient whether there has been any exposure to local anesthetic (dental procedures, etc.), or whether the patient has ever had an adverse reaction or side effect from an anesthetic or any other drug. Sensitivity to local anesthetics may be either due to the anesthetic itself or due to the preservatives.

Skin tests (prick/puncture and intracutaneous) have evolved as a reliable technique for the diagnosis of IgE-mediated drug reactions. The peak reactivity of prick/puncture tests is 15–20 min, at which time both wheal and erythema diameters (or areas) should be recorded in millimeters and compared with positive and negative controls. It should be recognized that prick testing will detect only the immediate type of hypersensitivity reactions: It may not detect delayed reactions and, hence, is not foolproof.

Delayed allergic reactions to local anesthetics

Cutaneous symptoms and systemic complaints occurring between 1h and several days after LA injections may be encountered in some patients. Inflammatory reactions confined to the injection site represent the most common, if not the only, clinical manifestation of late-type LA allergy. Delayed anaphylaxis to LA should be diagnosed by excluding the other causes of systemic symptoms.

Allergic reactions to lignocaine

Patients with true allergy to amide local anesthetics present a challenge in HT surgery for providing adequate care with appropriate intraoperative pain management. In case of allergic reactions to amide group anesthetics, ester-type anesthetics can be considered. Cross-reactivity between the amide and ester groups, although rare, had been reported to occur. The taskforce recommends that the patients with proven LA allergy should be referred to specialized allergy clinics for further evaluation with a skin prick test and they should be challenged with an unrelated LA to predict future safety.

Level of evidence: 3

Category of recommendation: C

REFERENCES

1. Mysore V, Nischal KC. Guidelines for administration of local anesthesia for dermatosurgery and cosmetic dermatology procedures. *Ind J Dermatol Venerol Leprol* 2009;75:68-75.
2. Jenerowicz D, Polańska A, Glińska O, Czarnecka-Operacz M, Schwartz RA. Allergy to lidocaine injections: Comparison of patient history with skin testing in five patients. *Postepy Dermatol Alergol* 2014;31:134-8.
3. Fuzier R, Lapeyre-Mestre M, Mertes PM, Nicolas JF, Benoit Y, Didier A, *et al.*; French Association of Regional Pharmacovigilance Centers. Immediate- and delayed-type allergic reactions to amide local anesthetics: Clinical features and skin testing. *Pharmacoepidemiol Drug Saf* 2009;18:595-601.
4. Trautmann A, Stovesandt J. Differential diagnosis of late-type reactions to injected local anaesthetics: Inflammation at the injection site is the only indicator of allergic hypersensitivity. *Contact Dermatitis* 2019;80:118-24.
5. Cherobin ACFP, Tavares GT. Safety of local anesthetics. *An Bras Dermatol* 2020;95:82-90.
6. Bhole MV, Manson AL, Seneviratne SL, Misbah SA. IgE-mediated allergy to local anaesthetics: Separating fact from perception: A UK perspective. *Bri J Anaesth* 2012;108:903-11.

TECHNIQUES TO REDUCE PAIN OF ANESTHESIA INJECTION

Most of the pain associated with a HT is during the local anesthesia (LA) injection. There are many techniques to reduce the perception of this pain. They could be used singly or in combination:

- a. Topical anesthesia: Eutectic mixtures help in reducing the initial pricking pain felt on piercing the skin with a needle. These mixtures need to be applied at least an hour before the injection of the anesthetic. Common mixtures used contain lignocaine with tetracaine or prilocaine.
- b. Warming the local anesthetic solution.

The simple procedure of warming to 37°C reduced the pain associated with a subcutaneous injection of lignocaine.

- c. Buffering the LA solution (Carbonation and pH adjustments).

The addition of sodium bicarbonate to the LA in order to raise the pH (known as buffering) decreases patient pain during drug delivery via subcutaneous or intradermal infiltration.

Most solutions were prepared by mixing 8.4% sodium bicarbonate and 1% lidocaine with epinephrine in a 1:9 or 1:10 ratio by volume; both proportions are effective in practice.

- d. Slow rate of injection.

Reducing the rate of administration of LA reduces pain and may have a greater impact on pain than buffering.

- e. Simultaneous stimulation of the surrounding skin

Based on the gate control theory, concomitant physical stimulation (non-painful input) closes the “gates” to painful input, which prevents pain sensation from traveling to the central nervous system. Stimulation of the skin using a vibrating device in the same dermatome results reduced perception of painful stimuli.

Level of evidence: 2

Category of recommendation: B

REFERENCES

1. Hogan ME, vanderVaart S, Perampaladas K, Machado M, Einarson TR, Taddio A. Systematic review and meta-analysis of the effect of warming local anesthetics on injection pain. *Ann Emerg Med* 2011;58:86-98.e1.
2. Strazar AR, Leynes PG, Lalonde DH. Minimizing the pain of local anesthesia injection. *Plast Reconstr Surg* 2013;132:675-84.
3. Gostimir M, Hussain A. A systematic review and meta-analysis of methods for reducing local anesthetic injection pain among patients undergoing periocular surgery. *Ophthalmic Plast Reconstr Surg* 2019;35:113-25.

LOCAL ANESTHETICS

The common anesthetics used for local anesthesia (LA) in HT are Lignocaine (with or without adrenaline), Bupivacaine, Levobupivacaine, and Ropivacaine.

Lignocaine is the most common LA used in HT surgery. The generally recommended maximum dose (Total Daily Dose) for local infiltration is 300 mg or 4.5 mg/kg of body weight. This can be increased to 500 mg or 7 mg/kg after adding adrenaline.

However, it is well recognized that the routine recommendations for infiltration anesthesia are not fully relevant in HT for the following reasons:

1. Tumescence anesthesia is practiced in HT and tumescent anesthesia allows higher doses to be administered.
2. Since multiple holes are made in the skin, in both donor and recipient area, much of the anesthetic oozes out and is not absorbed.
3. Anesthesia is administered in a graded fashion several times during the long surgery, and, hence, peak values may not be achieved.

However, it is advised that a careful watch is maintained on the amount of anesthetics administered, the quantity given be recorded and documented, and every effort made not to administer excess of anesthetic.

BUPIVACAINE

Bupivacaine is the most commonly used long-acting LA for HT surgery. The maximum daily dose is 175 mg. The use of bupivacaine is limited because of its potential cardiac toxicity. Bupivacaine produces a significantly greater depression of LV pressure than ropivacaine, mepivacaine, or lidocaine. Though these effects are rare with safe dosages, nevertheless there is potential for catastrophic events to occur.

LEVOBUPIVACAINE

Levobupivacaine is the pure S (–) enantiomer of bupivacaine and has emerged as a safer alternative for regional anesthesia than its racemic parent Bupivacaine. The maximum dose for levobupivacaine is 2 mg/kg and the maximum one-time dose is 200 mg. It is a viable alternative to bupivacaine as it is less cardiotoxic but the duration of action is less than bupivacaine but more than ropivacaine and ligocaine. Most of the clinical studies suggest that levobupivacaine is relatively less potent than bupivacaine, but it is more potent than ropivacaine.

ROPIVACAINE

Ropivacaine is a long-acting, enantiomerically pure (S-enantiomer) amide LA and regional anesthetic with an efficacy that is broadly similar to that of bupivacaine. In concentrations of 0.5% and higher, it produces dense blockade with a slightly shorter duration than that of bupivacaine. Various clinical trials have evaluated the safety profile of ropivacaine and found it to be safe. The maximum dose is 3 mg/kg and the maximum one-time dose is 200 mg.

MIXING LOCAL ANESTHETICS

It is unclear whether mixing multiple anesthetics for local infiltration poses further beneficial overuse of a single agent. The systemic effects produced by combinations of LA follow the principles of summation. When adhering to dosage limits, guidelines for various agents should be regarded as additive.

COMBINING LOCAL ANESTHETICS AND ADRENALINE

Use of the lowest effective concentration of adrenaline to provide pain control and vasoconstriction in local infiltrative anesthesia is recommended. The safe dosage of adrenaline is 0.01 mg/kg body weight. It is contraindicated in patients using the nonselective beta-blockers such as propranolol, since concomitant LA administration results

in unopposed alpha-receptor mediated vasoconstriction, which can theoretically produce a hypertensive emergency and a profound vagally mediated reflexive bradycardia. Local infiltrative anesthesia with adrenaline may be administered to patients with stable cardiac disease.

Category of recommendation: C

Level of evidence: 3

REFERENCES

1. Lam SM. Hair transplant and local anesthetics. *Clin Plast Surg* 2013;40:615-25.
2. Patwardhan N, Mysore V; IADVL Dermatotomy Task Force. Hair transplantation: Standard guidelines of care. *Indian J Dermatol Venereol Leprol* 2008;74 Suppl:S46-53.
3. Swinehart JM. Local anesthesia in hair transplant surgery. *Dermatol Surg* 2002;28:1189.
4. Nusbaum BP. Techniques to reduce pain associated with hair transplantation: Optimizing anesthesia and analgesia. *Am J Clin Dermatol* 2004;5:9-15.
5. Bagatin T, Bagatin D, Šakić L, Šakić K. Impact of local infiltration anaesthesia on post operative pain management after rhinoplasty in day care surgery. *Acta Clin Croat* 2019;58:62-6.
6. Kim H, Hwang K, Yun SM, Kim DJ. Usage of epinephrine mixed with lidocaine in plastic surgery. *J Craniofac Surg* 2020;31:791-3.
7. Parekh SB, Parikh SS, Patel H, Mehta M. A prospective comparative observational study of clinical efficacy of isobaric ropivacaine 0.75% with of isobaric bupivacaine 0.5% intrathecally in elective inguinal hernia repair surgeries. *Anesth Essays Res* 2017;11:561-6.
9. Heppollette CAA, Brunnen D, Bampoe S, Odor PM. Clinical pharmacokinetics and pharmacodynamics of levobupivacaine. *Clin Pharmacokinet* 2020;59:715-45.

SYSTEMIC TOXICITY OF LOCAL ANESTHETICS

Local anesthetic systemic toxicity (LAST) is a life-threatening adverse event that may occur after the administration of local anesthesia (LA) drugs through a variety of routes. In event of the overdose of LA toxicity, immediate management involves the general safety and resuscitation measures that are essential in any emergency. The taskforce recommends the following actions in case of LAST: The LA injection should be stopped; immediate priority is to manage the airway, breathing, and circulation; and the transfer of the patient to a tertiary care hospital should be planned. Early administration of 20% intravenous lipid emulsion therapy is recommended. An initial bolus of 100 mL should be administered over 2–3 min (1.5 mL/kg if the lean body weight is <70 kg). This is then to be followed by a 20% lipid emulsion infusion of 200–250 mL over 15–20 min (0.25 mL/kg/min if the lean body weight is <70 kg). If circulatory stability is not attained, re-bolusing up to two further times or increasing the infusion to 0.5 mL/kg/min is suggested. The maximum recommended dose of 20% lipid emulsion is 12 mL/kg.

Seizure activity may exacerbate metabolic acidosis, and prompt prevention and termination is crucial. Due to their cardiostable profile, benzodiazepines are the first-line therapy.

Advanced Cardiac Life Support algorithms for cardiopulmonary resuscitation must be followed should cardiac arrest occur. Chest compressions should be

initiated immediately and continued until return of spontaneous circulation. If epinephrine is used, small initial doses of $\leq 1 \mu\text{g/kg}$ are preferred to avoid impaired pulmonary gas exchange and increased afterload.

Level of evidence: 3

Category of recommendation: C

REFERENCES

1. Kubo A, Shimizu K, Kuroda K, Kanazawa T, Kobayashi M, Morimatsu H. Local anesthetic systemic toxicity following general and epidural anesthesia in a patient with a history of muscle relaxant-induced anaphylaxis. *Acta Med Okayama* 2019;73:543-6.
2. Hoegberg LC, Bania TC, Lavergne V, Bailey B, Turgeon AF, Thomas SH, *et al.*; Lipid Emulsion Workgroup. Systematic review of the effect of intravenous lipid emulsion therapy for local anesthetic toxicity. *Clin Toxicol (Phila)* 2016;54:167-93.
3. Cao D, Heard K, Foran M, Koyfman A. Intravenous lipid emulsion in the emergency department: A systematic review of recent literature. *J Emerg Med* 2015;48:387-97.
4. Sepulveda EA, Pak A. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-.2019 Nov 13.
4. Gitman M, Fettiplace MR, Weinberg GL, Neal JM, Barrington MJ. Local anesthetic systemic toxicity: A narrative literature review and clinical update on prevention, diagnosis, and management. *Plast Reconstr Surg* 2019;144:783-95.

EMERGENCY PREPAREDNESS IN HAIR TRANSPLANTATION

Plastic surgeries are classified into three types by the American Association for Accreditation of Ambulatory Surgery Facilities: Class A, minor plastic surgery procedures performed under local, regional, or topical anesthesia; Class A/B, minor or major plastic surgeries performed under intravenous or parenteral sedation, analgesia, or dissociative drugs; and Class A/B/C, major plastic surgeries performed under general anesthesia requiring external support of vital body functions. Surgeries are classified into three types based on the levels of Surgical Complexity: Level 1

- Minimal risk to the patient independent of anesthesia
- Minimally invasive procedures with little or no blood loss
- Often done in an office setting with the operating room principally for anesthesia and monitoring. HT surgery is categorized as Level I surgery and the facility it is performed in is Class A.

Monitoring the following equipment is mandatory for an HT OT:

1. Non-mercury/digital blood pressure apparatus
2. Stethoscope
3. Pulse oximeter
4. Glucometer
5. Digital thermometer
6. Weighing scale

RESUSCITATIVE EQUIPMENT NECESSARY FOR HAIR TRANSPLANT OPERATION THEATER

Resuscitation equipment should be located either in the room or within the premises, to allow basic cardiopulmonary resuscitation. Although there is some medico-legal responsibility, the major concern should be patient safety.

1. Intravenous access cannulas and IV sets
2. Laryngoscope
3. Endotracheal tubes
4. Suction equipment
5. Xylocaine spray
6. Airways: oropharyngeal and nasopharyngeal
7. Ambu Bag: Adult
8. Oxygen cylinders with flow meter/ tubing/catheter/ face mask/nasal prongs
9. Defibrillator with accessories (AED preferable)
10. Equipment for dressing/bandaging/suturing
11. ECG Machine

EMERGENCY DRUGS NECESSARY FOR HAIR TRANSPLANT OPERATION THEATER

1. Inj Adrenaline 1 mg
2. Inj Hydrocortisone 100 mg
3. Inj Atropine 1 mL
4. Inj. Pheniramine maleate 10 mL
5. Inj. Promethazine 1 mL
6. Inj. Deryphyline 2 mL
7. Inj. Frusemide 4 mL
8. Inj. Metoclopramide 2 mL
9. Inj. Dexamethasone 2 mL
10. Inj. Diazepam 10 mL
11. Inj. Dicyclomine Hydrochloride 2 mL
12. Inj. Ligocaine without preservative 30 mL
13. Inj. Intralipid 20% 500 mL
14. Inj. 5% dextrose infusion 100 mL
15. Inj. Normal saline 500 mL

Regular inspection of the drugs just mentioned to check their expiry dates should be done periodically.

LIFE SUPPORT TRAINING

Though rare, an HT surgeon may encounter an unresponsive patient or a sudden collapse in a patient. Preventing hypoxic brain damage is the most important task for the surgeon. The surgeon should have been trained in emergency resuscitation skills. If not, an anesthetist should be available for care in such situations. In addition, at least another member of the HT team should be trained in Basic Life Support.

Level of evidence: 4

Category of recommendation: D

REFERENCES

1. Singer Robert, Keyes Geoffrey, Nahai Foad. (2019). American Association for Accreditation of Ambulatory Plastic Facilities (AAAASF) History: Its role in plastic surgery safety. *Aesthetic Surgery Journal Open Forum*. 1. 10.1093/asjof/ojz008.
2. Pasternak LR. Screening Patients – Strategies and Studies. In: By Kathryn McGoldrick, editor. *Ambulatory Anesthesiology – A problem-oriented approach*. Philadelphia, PA: Williams and Wilkins; 1995. pp. 243.
3. Chakravarthy M. Complications of hair restoration surgery: An overview. In: Mysore V, editor. *Hair transplantation*. 1st ed. New Delhi: Jaypee Brothers Medical Publishers (p) Ltd; 2016. pp. 149-56.

TRANSFER ARRANGEMENTS

An arrangement should exist with a nearby hospital for the transfer of patients in the event of unexpected serious or potentially serious developments. Surgeons performing office-based HT surgery must have admitting privileges at a nearby hospital or maintain an emergency transfer agreement with a nearby hospital. Ambulance or patient transport services, if provided, should be organized through defined policies and procedures for efficient and effective services. Ambulance or patient transport services, if provided, should comply with the legal and regulatory requirements. Relevant telephone numbers should be displayed prominently, and all staff should be familiar with the telephone numbers.

PRESENCE OF ANESTHETIST DURING HAIR TRANSPLANT PROCEDURE

Typically, patients of HT belong to ASA 1 category (normal healthy patient, nonsmoking, no or minimal alcohol use) and hence the presence of an anesthetist is not routinely necessary. The presence of an anesthetist is not necessary if:

- (a) the surgeon is well versed with advanced cardiac life support skills
- (b) the team is Basic Life Support certified
- (c) all the necessary monitoring and resuscitative equipment is handy
- (d) anesthetist services can be accessed easily and quickly
- (e) the anesthetist services have transfer arrangements with a nearby hospital

When dealing with ASA II (patient with mild systemic disease without substantive functional limitations): Examples include (but not limited to): current smoker, social alcohol drinker, obesity ($30 < \text{BMI} < 40$), well-controlled diabetes mellitus/hypertension, mild lung disease, elderly patient, etc. In such cases, the presence of an anesthetist is advised by the taskforce. Some hair restoration surgeons use parenteral sedatives to create a state of conscious sedation during local anesthesia administration. In this scenario also, the taskforce recommends that the presence of a qualified anesthetist is necessary, not only to monitor the patient but also to

manage the patient in case the level of sedation becomes deeper.

The taskforce recommends routine periodic recording and documentation of the vital parameters during the course of surgery. It would be optional for ASA grade 1 but mandatory for ASA grade 2 (hypertension, mild cardiac disease, etc.).

Level of evidence: 4

Category of recommendation: D

HT PRACTICE GUIDELINE: PART 4

Surgical aspects of hair transplantation

Introduction

A wide variation exists in the techniques of HT surgery. This part of the guidelines recommends the minimum standard of care in assessing the donor area, surgical steps in follicular unit excision/FUT surgery, recommendations for the magnification, hairline design, duration of the surgery, and the role of platelet rich plasma (PRP) in HT surgery.

Donor area issues

Safe donor area

Donor harvesting should be from a safe donor area only, and the taskforce discourages harvesting from a nonsafe area, as such hairs would be lost over time. Detailed physical examination and trichoscopic hair analysis should be done to determine donor hair quality (curly or straight), density (must be checked at multiple points, including occipital and temporal), hair caliber, ethnicity, etc.; determination of the safe donor area (SDA) with a focus on areas of hair thinning or retrograde alopecia, if any, should be documented and explained to the patient. Non-scalp donor areas (body hairs) should also be evaluated since too much extraction from SDA might destroy the donor area aesthetics. It is recommended that the surgeon should stay within the SDA while performing excisions, which is a 189–203 cm² depending on individual and ethnic variations. There can never be one valid, totally SDA for all patients. The SDA was first suggested by Unger *et al.* in 1994 and this continues to be the global standard. Other SDA definitions by Cole, Alt, Bernstein, and Rasmann can be considered for demarcating the SDA. A family history, assessment of the future progression of the AGA, and clinical examination would be necessary to confirm the boundaries of SDA. One should always err on the side of caution.

Grade of Recommendation: C

Level of evidence: 3

REFERENCES

1. Unger W, Solish N, Giguere D. Delineating the “Safe” donor area for hair transplanting. *Am J Cosmet Surg* 1994;11:239-43.

- Devroye J. An overview of the donor area: Basic principles. In: Unger WP, Shapiro R, Unger R, Unger M, editors. Hair transplantation. 5th ed. New York: Informa Health Care; 2011. pp. 247-62.
- Kumaresan M, Mysore V. Controversies in hair transplantation. *J Cutan Aesthet Surg* 2018;11:173-81.
- Yepuri V, Mysore V. Effects of hormones on hair. In: Mysore V, editor. Hair transplantation. 1st ed. New Delhi, India: Jaypee; 2016. pp. 21-3.
- Devroye J. An overview of the donor area: Basic principles. In: Unger WP, Shapiro R, Unger R, Unger M, editors. Hair transplantation. 5th ed. New York: Informa Health Care; 2011. pp. 247-62.
- Bernstein RM, Rassman WR. Follicular transplantation. Patient evaluation and surgical planning. *Dermatol Surg* 1997;23:771-84; discussion 801-5.
- Park JH, Na YC, Moh JS, Lee SY, You SH. Predicting the permanent safe donor area for hair transplantation in Koreans with male pattern baldness according to the position of the parietal whorl. *Arch Plast Surg* 2014;41:277-84.

MINIATURIZATION IN THE DONOR AREA

A safe donor area should be evaluated for miniaturization and if present, this should be informed to the patient; excision of grafts should be done carefully to avoid miniaturized hairs since this might hamper the HT result and overharvesting might leave visible depletion of the donor zone. Diffuse type of AGA should always be considered in such cases. Medical treatment and body hair harvesting should be considered in these types of patients.

Grade of Recommendation: D

Level of evidence: 3

REFERENCES

- Bernstein RM, Rassman WR. Hair Transplant Forum International March/April 2007;17:201-3.
- Tobin DJ, Gunin A, Magerl M, Handijski B, Paus R. Plasticity and cytokinetic dynamics of the hair follicle mesenchyme: Implications for hair growth control. *J Invest Dermatol* 2003;120:895-904.
- Garza LA, Yang CC, Zhao T, Blatt HB, Lee M, He H, *et al.* Bald scalp in men with androgenetic alopecia retains hair follicle stem cells but lacks CD200-rich and CD34-positive hair follicle progenitor cells. *J Clin Invest* 2011;121:613-22.

MAXIMUM GRAFTS THAT CAN BE SAFELY HARVESTED FROM SDA

This would depend on:

- Safe donor area
- Donor density of both hairs and units
- Size of head
- Techniques used
- Donor skin properties such as elasticity
- Age of patient and possibility of future sessions

Hence, individual variations may occur. The range of safe upper limit can vary from 4000 to 6500 scalp grafts over a lifetime over multiple sessions and different techniques. Without causing visible depletion of the donor area in one session, an average of 2500 to 3000 grafts per session is considered as the optimum upper limit of graft harvesting.

Grade of Recommendation: D

Level of evidence: 3

REFERENCES

- Bernstein RM, Rassman WR. Follicular transplantation. Patient evaluation and surgical planning. *Dermatol Surg* 1997;23:771-84; discussion 801-5.
- Harris JA. Application of the Hair Diameter Index (HDI) in Obtaining a Target Hair Density Poster Presentation, International Society of Hair Restoration, 11th Annual Meeting, New York, NY, October 2003.
- Harris JA. Introduction of the Hair Volume Index (HVI) and Its Correlation to Subjective Visual Hair Density". Scientific Session Presentation and Poster Presentation, International Society of Hair Restoration Surgery 11th Annual Meeting. New York, NY, October 2003

FOLLICULAR UNIT EXCISION

Follicular unit excision (FUE) involves harvesting hairs from the donor area, under local anesthesia, which is most commonly the scalp but occasionally the beard, chest, and other parts of the body, using circular punches of less than 1 mm diameter, mounted on a manual handle or a motorized hand device or, more recently, a robotic device. There are several options for the punches available. The taskforce recommends that the choice of the punch depends on the individual surgeon's comfort level in reducing the transection of the follicles and to provide optimum outcome and the diameter of the punch to be preferably less than 1 mm. Punches larger than 1 mm are not recommended. Patients' skin characteristics such as variations in the thickness of epidermis, dermal-epidermal junction, and subcutaneous tissue contribute to the challenges of donor harvesting and for obtaining low follicular transection rates. Overharvesting should be avoided, as it may lead to scarring and depigmentation, particularly in patients with darker skin. It is preferable to excise 1 unit out of four follicular units, leaving one intact all around. A general recommendation is to harvest 10–15 excisions/cm² as a safe single-pass density in a person with a baseline average density of 65–75 follicles/cm². A good magnification device is recommended for the FUE procedure to orient for the follicular unit angle of exit and better excision without transaction.

Level of evidence: 3

Category of recommendation: C

REFERENCES

- Devroye J. Donor area harvesting. In: Unger, editor. Hair transplantation. 5th ed. London, UK: Informa Health Care; 2011. pp. 247-8.
- Garg AK, Garg S. Donor harvesting: Follicular unit excision. *J Cutan Aesthet Surg* 2018;11:195-201.

STRIP EXCISION

The size of the strip depends on the demand of number of grafts at recipient site, donor zone elasticity and the donor hair density. Preoperative estimation of scalp laxity and glidability will aid in determining the optimal width to be harvested and also in preventing wound dehiscence postoperatively. The width of the scar is directly proportionate to the width of the strip removed and tension on the wound margins. The width should be preferably less than 1.3 cm. It may be necessary to alter the width of the strip in some areas of increased tension or due to the presence of a preexisting scar.

Evidence level: 3

Grade of recommendation: C

REFERENCES

1. Marzola M. Single-scar harvesting technique. In: Haber R, Stough D, editors. Hair transplantation. Philadelphia (PA): Elsevier Saunders; 2005. pp. 83-7.
2. Mayer ML. Evaluation of scalp elasticity. In: Unger W, Shapiro R, Unger R, Unger M, editors. Hair transplantation. 5th ed. London, United Kingdom: Informa Healthcare; 2011. pp. 267-70.
3. Huang YL, Chang SL, Lee MC, Chang CH, Hu S, Gold MH. Measuring occipital scalp laxity before donor strip harvesting in hair transplantation. *J Drugs Dermatol* 2014;13:1248-52.
4. Park JH. Association between scalp laxity, elasticity, and glidability and donor strip scar width in hair transplantation and a new elasticity measuring method. *Dermatol Surg* 2017;43:574-81.

STRIP HARVEST

A single-strip elliptical excision is the gold standard technique with a strip centered around occipital protuberance. More superficial scoring incision, angle of the blade parallel to the hair shaft, blunt dissection for separating the scored tissue, and working under good magnification result in lesser transaction rates during the strip excision. It is advisable to wait for a minimum of 9–12 months before taking a revision strip surgery.

REFERENCES

1. Tan TY, Pathomvanich D, Castillejes D, Thienthaworn P, Manochai S, Lu N. Follicular transection rate in FUT in Asians: 15 years later. *Hair Transpl Forum Intl* 2017;27:1-4.
2. Ahmad M. Comparison of three strip harvesting techniques (Haber's, Pathomvanich's and Ahmad's techniques). *J Cosmet Dermatol* 2019;18:589-93.
3. Pathomvanich D. Donor harvesting: A new approach to minimize transection of hair follicles. *Dermatol Surg* 2000;26:345-8.

Evidence level: 3

Grade of recommendation: C

WOUND CLOSURE

Depth of dissection and undermining of the edges has been the subject of much debate and at present no uniform recommendations can be made. However, deeper dissection and undermining is associated with a greater

risk of injury to vessels and therefore bleeding, needing greater surgical skills. Excessive inadvertent coagulation should be avoided, as it can damage the surrounding follicle and eventually delay healing and might lead to a bad scar.

SUTURING AND SUTURE MATERIAL

- Closure of the strip wound may be performed with sutures (either continuous or intermittent) or with staples, as each of these has its own advantages. The running suture can strangulate the follicles if wound tension is more or if there is significant post-op edema, and it can result in localized hair loss around the suture line and a bad scar unlike staples.
- The quality of the scar is dependent on the amount of width of the strip that is removed during the surgery. Though single-layer closure has been reported to be much faster and cost-effective than double-layer closure, taskforce recommends that strips less than 1.2 cm can be closed in a single layer and that strips more than 1.2 cm must be closed in a double layer.
- Trichophytic closure results in minimizing scarring by regrowing hair through the scar tissue and hence camouflages donor scars. Deepithelialization of the inferior edge of the scalp wound margin is recommended, as the upper edge will slide over the deepithelialized lower edge during the wound closure during the trichophytic closure technique.
- To minimize the reaction from the absorbable sutures, it has been suggested that the use of nonabsorbable sutures such as 3 "0" Nylon interrupted sutures, for the deeper layer to reduce tension on the suture line. The skin can be approximated with 4"0" polyglactin910.

Evidence level: 3

Grade of recommendation: C

REFERENCES

1. Dua K, Uprety S, Dua A. Donor harvesting: Strip dissection. *J Cutan Aesthet Surg* 2018;11:190-4.
2. Ghamdi WA. Vertical harvesting in hair transplantation. *Dermatol Surg* 2001;27:597-600.
3. Sam LM. Hair Transplant Operative 360. In: Sam LM, editor. Hair transplant 360 for physicians. New Delhi, India: Jaypee Brothers Medical Publisher; 2011. pp. 47-126.
4. Ahmad M. Single-layer vs. double-layer donor scalp wound closure in strip harvest. *Arch Aesthetic Plast Surg* 2017;23:36-40.
5. Adeolu AA, Olabanji JK, Komolafe EO, Ademuyiwa AO, Awe AO, Oladele AO. A prospective study of two methods of closing surgical scalp wounds. *Br J Neurosurg* 2012;26:75-7.
6. Bezwada RS, Jamiolkowski DD, Lee IY, Agarwal V, Persivale J, Trenka-Benthin S, *et al.* Monocryl suture, a new ultra-pliable absorbable monofilament suture. *Biomaterials* 1995;16:1141-8.
7. Bernstein RM, Rassman WR, Rashid N. A new suture for hair transplantation: Poliglecaprone 25. *Dermatol Surg* 2001;27:5-11.
8. 17 STAPLES REVISITED, Bernstein RM, *Hair Transplant Forum International* 2008;18:10–11.

9. Muthuvel K, Lakshmikanthan S, Subburathinam D. Outcomes of staple closure of the donor area during hair transplant by follicular unit transfer. *J Cutan Aesthet Surg* 2014;7:103-6.
10. Mubashir S, Sajad P, Rasool F, Hasan I, Bhat YJ. Conventional suture material versus staplers in the closure of donor area in hair transplant. Which is better? *Hair Ther Transplant* 2015;5:1000139.
11. Yamamoto K. Double trichophytic closure with wavy two-layered closure for optimal hair transplantation scar. *Dermatol Surg* 2012;38:664-9.
12. Yamamoto K. Trichophytic closure of both wound edges after strip excision for hair transplantation. *Hair Transplant Forum Int* 2009;19:185,190-1.

MAGNIFICATION FOR THE WORKING FIELD

Magnification for the working field and a clear visualization of the follicles is essential to avoid transection during the process of strip harvesting, slivering, and dissection of follicular units. Various magnification devices such as a stereo microscopes, video microscopes, and magnifying loupes have been routinely used by the surgeons and their team. It is recommended that stereomicroscopic dissection be done for proper identification and dissection to minimize transection during the slivering process. Though stereomicroscopic dissection at magnification of 10–25x gives a good clarity, magnification of 2.5 to 4x can be used to dissect the slivers into follicular grafts.

Evidence level: 3

Grade of recommendation: D

RECIPIENT AREA

Male hairline design

The design of the anterior hairline (AHL) is the biggest challenge and most demanding step in hair restoration surgery. It should be designed in such a way so that it not only fulfills present demand but also looks natural for future facial changes, and it should have an undetectable grafty look and be reasonably dense.

The problems with hairline design

1. Most patients ask for a hairline that they had during their teenage years. Making such a lower hairline does not match with facial changes as age advances and, hence, may look unnatural with time. Providing a lower hairline usually consumes a greater number of grafts.
2. Another demand from the patients is to make the frontotemporal angle obtuse and at a low level. The round or obtuse frontotemporal angles are present in the female hairline and may look unnatural when created for men.

Factors for AHL design

1. Age, hair characteristics, facial features, sex, and ethnicity of the patients should be considered.

2. The placement of AHL should be done preferably higher on the forehead rather than at a lower level. A hairline that is placed higher can be lowered down in future, but the opposite is not possible.
3. A reconstructed hair line should look natural, aesthetically appealing and future hair loss and facial changes with aging should be considered before concluding the final AHL placement.
4. Active involvement of the patient with detailed explanation of the aesthetic concept of the hairline should be done prior to the surgery.
5. Frontotemporal point of the AHL should be at the same level or higher than the midfrontal point.
6. Frontotemporal angle should be in line with the vertical canthal line. The hairline should be aligned so that the receding of the midfrontal point and the frontotemporal angle should be in the same proportion.
7. The distance between the midfrontal and temporal point in the lateral facial profile should not be more than 3 cm.
8. For a severe degree of hair loss where the parietal hump has fallen down, it should be reconstructed to meet the new AHL.
9. In a severe degree of temporal recession, temporal fringe reconstruction should be planned to improve the aesthetics of the face in lateral profile.
10. The AHL should have the following components: micro- and macro-irregularities, transition zone, defined zone, and central tuft.
11. The final placement of AHL is to be individualized depending on size and shape of the head, degree of alopecia, and sometimes the patient's wish. The patient's desire for a low hairline can be fulfilled by a properly constructed "widows peak."

Level of evidence: 4

Category of recommendation: D

Temporal triangle reconstruction

This is an important area of reconstruction for complete aesthetic restoration of the face. The temporal triangle plays an important role in side framing of the face. If enough donor grafts are available, the surgeon will reconstruct this area.

Level of evidence: 4

Category of recommendation: D

Vertex transplant

Vertex area reimplant is a challenge for every HT surgeon. As compared with the front area of the head, the vertex consumes more number of grafts. It is very commonly called as "black hole." Vertex reconstruction is better avoided in young individuals.

Level of evidence: 4

Category of recommendation: D

REFERENCES

1. Ronald Shapiro - Principles of creating a natural Hairline. In: avenger W, shapiro R, editors. Hair transplantation. 5th ed. Inform healthcare, 2011: 374.
2. Ronald Shapiro Principles & Techniques used to create a Natural Hairline surgical Hair Restoration. *Facial Plast Surg Clin North Am* 2004;12:201-18.
3. Paul T. Rose, William M. Parsley. Science of hairline design. In: Robert s Haber, Dowling B stough, editors. Procedures in dermatology – hair transplanting. 1st ed. Elsevier; 2006. pp. 55.
4. Simons C. Five old lines and these new lines that can help when designing a male temporal. Hairline or when transplanting the front temporal apex. *Hair Transpl Forum Int* 2004;14:201-3.
5. Ziering C, Krenitsky G. The Ziering Whorl classification of scalp hair. *Dermatol Surg* 2003;29:817-21; discussion 821.
6. Mayer ML, Perez-Meza D. Temporal Points: Classification and surgical Techniques for Aesthetic results. *Hair Transplant Forum International* 2002;12:147-58.
7. Beehner M. Where is thy crown, your Majesty? *HT Forum International* 1998;8:18-9.
8. Rose PT. Consideration in establishing the hairline. *Int J Aesth Rest Surg* 1998;1:24-6.
9. Garg AK, Garg S. Decoding facial esthetics to recreate an esthetic hairline: A method which includes forehead curvature. *J Cutan Aesthet Surg* 2017;10:195-9.

Female hair transplant and planning and designing anterior hairline

Detailed counseling is necessary in women who have an unrealistic expectation of achieving a full head of hair after the HT. Even when surgical technique and hair survival is excellent, the patient may be very dissatisfied because of poor communication and/or mismatched expectations.

A detailed examination of the recipient area and the donor area to look for diffuse thinning is necessary. General physical examination to look for underlying medical conditions, nutritional deficiencies, and other systemic diseases should be done in all the female patients. These women need to be counseled to seek alternative treatments, including medical treatments, scalp-coloring agents, improved hairstyling, or hairpieces.

Commonly, the areas treated in women include one or more of the following: the hairline, the midline frontal zone just posterior to the hairline, a desired part-line, the center of the vertex, the frontotemporal recessions, and the central caudal region.

Planning of anterior hairline in females

1. Hairline is at a lower level on the vertical portion of the forehead.
2. Frontotemporal angle is obtuse and rounded.

3. A widow's peak or cowlick is usually located in the center of the AHL; the central peak is generally associated with later smaller peaks or mounds.

Level of evidence: 4

Category of recommendation: D

REFERENCES

1. Unger WP. Hair transplantation in females. In: Unger WP, Nordstrom RE, editors. Hair transplantation. 2nd ed. New York: Marcel Dekker; 1988. pp. 295-300.
2. Unger WP, Unger RH. Hair transplantation: An important but often forgotten treatment option for female pattern hair. *J Am Acad Dermatol* 2003;49:853-60.
3. Shapiro J. Clinical practice. Hair loss in women. *N Engl J Med* 2007;357:1620-30.
4. Nussbaum BP, Fuentesfria S. Naturally occurring female hairline patterns. *Dermatol Surg* 2009;35:907-14.

SOME IMPORTANT SPECIFIC ISSUES

Maximum duration of surgery and graft survival rate

There is no specific recommendation of the duration of surgery. However, out-of-body time for grafts, patients' safety, comfort, physician fatigue, assistants' fatigue, amount of anesthesia and its duration, and patients' state of health need to be taken into account. It must always be remembered that HT is a cosmetic surgery and it is preferable, when a large number of grafts are needed to repeat the surgery than perform prolonged surgeries in one session. Although graft survival has been seen up to 6 h of outside body time, it is preferred to insert the grafts within the first 2–4h itself to maximize the graft survival and hence the overall result.

Grade of Recommendation: D

Level of evidence: 3

REFERENCES

1. Unger W. Effect of rapid transfer of grafts from the donor area to the recipient site. In: Unger W, Shapiro R, editors. Hair transplantation. 4 th ed. New York: Marcel Dekker; 2004. pp. 295.
2. Limmer R. Micrograft survival. In: Stough D, Haber R, editors. Hair replacement. St Louis, MO: Mosby press; 1996. pp. 147-9.
3. Raposio E, Cella A, Panarese P. Effects of cooling micrografts in hair restoration surgery. *Dermatol Surg* 1999;25:705-07.
4. Hwang SJ. The effects of dehydration, preservation temperature and time on the hair grafts. *Ann Dermatol* 2002;14:149-52.

COMBINATION SURGERIES

In several situations, a combination of techniques (FUT and follicular unit excision) or harvesting from multiple areas (scalp, beard, body) may be needed. These include: advanced grades of alopecia, to maximize the output of the donor grafts, during revision surgeries, second session,

diffuse pattern hair loss, and in those with limited donor area combination. Such combination surgeries require expertise in view of longer operating hours, increased anesthetic dose, and patient tolerance. Such combinations can be done either on the same day, after proper assessment by the treating surgeon, or on separate days, depending on the given situation in each case.

Grade of Recommendation: D

Level of Evidence: 3

REFERENCES

1. True R. Combining FUE and Strip Harvesting in the same procedure. Presenting at Seventeenth Annual of the ISHRS, Amsterdam, July 2009;
2. Tsilosani A. Expanding graft numbers combining strip and FUE in the same session. *Hair Transplant Forum Int* 2010;20:121-3.

PRP IN ANDROGENETIC ALOPECIA AND HT

The available literature suggests that PRP may be effective in treating AGA and may act to reduce hair loss, increase hair diameter and density. However, there exist large variations in optimal PRP preparation method, the optimal frequency, treatment interval, and the long-term efficacy of PRP treatment.

To validate the efficacy and safety of PRP in treating hair loss, more RCTs are required, with standard protocols concerning more objective evaluation of hair loss, the number and interval of treatment sessions, the number of platelets, the method of activation, and the long-term follow-up outcomes.

It is also true that an increasing number of publications have been produced over the past two years, though of lower quality, and the treatment is easy, safe, and cheap. Hence, the taskforce recommends its use as an adjuvant along with other modifications and not as a monotherapy or first-line treatment. The recommendation can be renewed as further evidence becomes available.

The PRP is also used in various steps of the HT procedure intraoperatively to augment the result of HT. The studies reported so far, though small, have documented the reduction in postoperative hair loss after HT and early regrowth of implanted hair. PRP treatment is safe during HT and has strong logic, but it needs validation through proper controlled trials. It is also true that there is no other ideal holding solution. Taskforce recommends its use during the procedure with proper informed consent.

Level of evidence: 2

Category of Recommendation: B

REFERENCES

1. Li ZJ, Choi HI, Choi DK, Sohn KC, Im M, Seo YJ, *et al.* Autologous platelet-rich plasma: A potential therapeutic tool for promoting hair growth. *Dermatol Surg* 2012;38:1040-6.
2. Dhurat R, Sukesh M. Principles and methods of preparation of platelet-rich plasma: A review and author's perspective. *J Cutan Aesthet Surg* 2014;7:189-97.
3. Miao Y, Sun YB, Sun XJ, Du BJ, Jiang JD, Hu ZQ. Promotional effect of platelet-rich plasma on hair follicle reconstitution in vivo. *Dermatol Surg* 2013;39:1868-76.
4. Schiavone G, Raskovic D, Greco J, Abeni D. Platelet-rich plasma for androgenetic alopecia: A pilot study. *Dermatol Surg* 2014;40:1010-9.
5. Cervelli V, Garcovich S, Bielli A, Cervelli G, Curcio BC, Scioli MG, *et al.* The effect of autologous activated platelet rich plasma (AA-PRP) injection on pattern hair loss: Clinical and histomorphometric evaluation. *Biomed Res Int* 2014;2014:760709.
6. Khatu SS, More YE, Gokhale NR, Chavhan DC, Bendsure N. Platelets-rich plasma in androgenic alopecia: Myth or an effective tool. *J Cutan Aesthet Surg* 2014;7:107-10.
7. Greco J, Brandt R. The effects of autologous platelet rich plasma and various growth factors on non-transplanted miniaturized hair. *Hair Transplan Forum Int* 2009;19:49-50.
8. Lopez V, Vaya A, Bautista D, Ricart JM. Autologous platelet-rich plasma as a potential therapeutic tool in androgenetic alopecia. *J Am Acad Dermatol* 2013;68:SAB103.
9. Gkini MA, Kouskoukis AE, Tripsianis G, Rigopoulos D, Kouskoukis K. Study of platelet-rich plasma injections in the treatment of androgenetic alopecia through an one-year period. *J Cutan Aesthet Surg* 2014;7:213-9.
10. Qu Q, Shi P, Yi Y, Fan Z, Liu X, Zhu D, *et al.* Efficacy of platelet-rich plasma for treating androgenic alopecia of varying grades. *Clin Drug Investig* 2019;39:865-72.
11. Hesseler MJ, Shyam N. Platelet-rich plasma and its utilities in alopecia: A systematic review. *Dermatol Surg* 2019;17:93-102.
12. Mao G, Zhang G, Fan W. Platelet-rich plasma for treating androgenic alopecia: A systematic review. *Aesthetic Plast Surg* 2019;43:1326-36.
13. Verma K, Tegta GR, Verma G, Gupta M, Negi A, Sharma R. A study to compare the efficacy of platelet rich plasma and minoxidil therapy for the treatment of androgenetic alopecia. *Ind J Tricology* 2019;11:68-79.
14. Bayat M, Yazdanpanah MJ, HamidiAlamdari D, Banihashemi M, Salehi M. The effect of platelet-rich plasma injection in the treatment of androgenetic alopecia. *J Cosmet Dermatol* 2019;18:1624-8.
15. Stevens J, Khetarpal S. Platelet-rich plasma for androgenetic alopecia: A review of the literature and proposed treatment protocol. *Int J Womens Dermatol* 2019;5:46-51.
16. Shetty VH, Goel S. Dermoscopic pre- and posttreatment evaluation in patients with androgenetic alopecia on platelet-rich plasma-A prospective study. *J Cosmet Dermatol* 2018;8:1380-8.
17. Butt G, Hussain I, Ahmed FJ, Choudhery MS. Efficacy of platelet-rich plasma in androgenetic alopecia patients. *J Cosmet Dermatol* 2019;18:996-1001.
18. Rodrigues BL, Montalvão SAL, Cancela RBB, Silva FAR, Urban A, Huber SC, *et al.* Treatment of male pattern alopecia with platelet-rich plasma: A double-blind controlled study with analysis of platelet number and growth factor levels. *J Am Acad Dermatol* 2019;80:694-700.
19. Hausauer AK, Jones DH. Evaluating the efficacy of different platelet-rich plasma regimens for management of androgenetic alopecia: A single-center, blinded, randomized clinical trial. *Dermatol Surg* 2018;44:1191-200.
20. Chen JX, Justicz N, Lee LN. Platelet-rich plasma for the treatment of androgenic alopecia: A systematic review. *Facial Plast Surg* 2018;34:631-40.

21. Cervantes J, Perper M, Wong LL, Eber AE, Villasante Fricke AC, Wikramanayake TC, *et al.* Effectiveness of platelet-rich plasma for androgenetic alopecia: A review of the literature. *Skin Appendage Disord* 2018;4:1-11.
22. Giordano S, Romeo M, di Summa P, Salval A, Lankinen P. A meta-analysis on evidence of platelet-rich plasma for androgenetic alopecia. *Int J Trichology* 2018;10:1-10.
23. Gupta AK, Versteeg SG, Rapaport J, Hausauer AK, Shear NH, Piguet V. The efficacy of platelet rich plasma in the field of hair restoration and facial aesthetics – A systematic review and meta-analysis. *J Cutaneous and Med Surg* 2019;23: 185-203.
24. Puig CJ, Reese R, Peters M. Double-blind, placebo-controlled pilot study on the use of platelet-rich plasma in women with female androgenetic alopecia. *Dermatol Surg* 2016;42:1243-7.
25. Garg AK, Garg S. A histological and clinical evaluation of plasma as a graft holding solution and its efficacy in terms of hair growth and graft survival. *Hair Transplant Forum Int* 2018;28: 89,94-6.
26. Uebel CO, da Silva JB, Cantarelli D, Martins P. The role of platelet plasma growth factors in male pattern baldness surgery. *Plast Reconstr Surg* 2006;118:1458-66.
27. Garg S. Outcome of intra-operative injected platelet-rich plasma therapy during follicular unit extraction hair transplant: A prospective randomised study in forty patients. *J Cutan Aesthet Surg* 2016;9:157-64.

SUMMARY

The objective of these guidelines is to recommend minimum standards for practice of HT. The principles outlined in these guidelines are of a general nature only and are not meant to cover all situations. The taskforce emphasizes that each patient has to be treated on his/her own merit and that these guidelines do not limit the physician from making an appropriate choice or the necessary innovation for a given patient.