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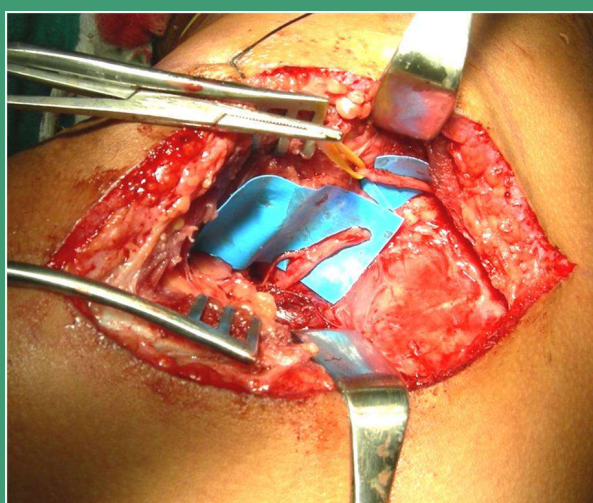


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# ***YOUR HEALTH***

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## **Plastic Surgery**

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# INDIAN MEDICAL ASSOCIATION



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# YOUR HEALTH OF INDIAN MEDICAL ASSOCIATION HEADQUARTERS (KOLKATA)



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Dr Samarendra Kumar Basu

## Editorial

## Sir Nilratan Sircar

When in the month of July we are celebrating Doctors' Day, the Birth Day of Dr. Bidhan Chandra Roy, we must remember Sir Nilratan Sircar another son of the soil, the legend of medical fraternity from Bengal.

Sir Nilratan Sircar was born in a humble family in the village of Netra near Diamond Harbour in 1861. His father's name was Nanda Lal Sircar. After passing his Entrance examination from the Jaynagar H.E. School he qualified as a sub-assistant surgeon from the Campbell Medical School. He joined the staff of the University School founded by Dr. Aghore Chatterjee (father of Mrs. Sarojini Naidu). He was in the school for about a year and then took his admission into the Medical College in 1885. In the Medical College he was noted both for industry and brilliance. He was the Goodeve Scholar and obtained honours in Midwifery and Medical Jurisprudence. While still a student, he read a paper on the Etiology of Infantile Liver (Biliary Cirrhosis) before the Calcutta Medical Society, which was published in the Indian Medical Gazette in 1887.



He obtained his M.B. degree in 1888, and joined the Mayo Hospital as House Surgeon in the same year. His thirst for knowledge, however, could not be satiated with so little. He went in for the M.A. degree which he followed up by obtaining the M.D. degree of the Calcutta University.

For the first time in the history of medical profession in this country he began to charge the same amount of fees as the highest European practitioners. Sir Nilratan held that they should establish this principle that, given equal opportunities, an Indian could rise to the level of a European in every sphere of life. Thus he was instrumental in raising the status of the Indian doctors.

Sir Nilratan believed that Indian young man studying medicine should be taught by Indians and with that end in view, he together with the Late Drs. R. G. Kar and Suresh Prosad Sarbadhikary, started an institution in Calcutta, the first non-official institution of its kind in the whole of India. He was also the President of Carmichael Medical College. In recognition of the distinguished services to this institution, a Research Institute named after him was created in 1942 for carrying on research in various problems peculiar to this country.

He was elected President of the Indian Medical Association in 1931-32. He was also one of the founders of the Journal of the Indian Medical Association, which made its appearance in 1930 under his editorship. It was then named as "Indian Medical World". The name was changed to the present title from 1931 but he continued to act as the Editor and served the Journal for over a decade.

He took keen interest in the industrial development of Bengal and he encouraged, patronised and sponsored several industrial enterprises. His was an idealistic outlook and financial entanglement could not curb his zeal. The great possibility of Indian home industry attracted his attention and he saw what a great drain it was on the wealth of the country. Sir Nilratan took the bold step of founding an Indian-owned tannery, the first of its kind, in the face of tremendous opposition from vested interests. Then he undertook manufacture of soap and the soap works founded by him was a pioneer work in India.

Throughout his life Sir Nilratan took an active interest in politics and had been a delegate of the Indian National Congress since 1890. He felt and made no secret of it that its political outlook and programme lacked idealism and vigour. He was a great admirer of Gandhiji, and Gandhiji also held him in high esteem. Sir Nilratan's statesmanship was of high order, there was nothing personal about it.

He was in the Bengal Legislative Council from 1912-1927. He did his work in the Council in his usual thorough way and devoted much time. A Knighthood was conferred on him in 1918.



Dr Sarbari Dutta

## From the Desk of Secretary

## Sushruta – The Father of Plastic Surgery

Sushruta is considered the "Father of Plastic Surgery." He lived in India sometime between 1000 and 800 BC and is responsible for the advancement of medicine in ancient India.

The name "Plastic" isn't taken from the synthetic substance but from the Greek word *plastikos*, which means to form or mold (and which gives the material plastic its name as well). Plastic surgery is a special type of surgery that can change a person's appearance and ability to function.

The ancient Indian surgeon Sushruta originally described the value of pedicle for the viability of flaps. He utilized pedicle-based cheek flaps, "Sānubandhen Jèvitah," to reconstruct the nose and ears. This fundamental understanding paved the way for modern-day reconstructive surgery. In the present context, India, the Land of Sushruta, is taking a lead role as Sānubandhen Jèvitah in propagating the "World Plastic Surgery Day" from 2021 onwards.

Coimbatore-based plastic surgeon S. Raja Sabapathy introduced the concept of National Plastic Surgery Day when he was the APSI president in 2011 to create awareness of plastic surgery. Every plastic surgeon in the country did one free surgery to mark the inaugural year. India celebrates the National Day of Plastic and Reconstructive Surgery every July 15 since 2011. After a decade of successful implementation, now July 15 marks World Plastic Surgery Day. In 2021 American Society of Plastic Surgery (ASPS) Global Summit of 34 national plastic surgery societies, the proposal was introduced by the APSI President Prof. R.K. Khazanchi. Responding to our president's solicitation, the ASPS has pronounced July 15 as the 'World Plastic Surgery Day.' This is indeed a privilege for Indian counterparts who have taken the initiative from the outset. A global day is an excellent opportunity for the international plastic surgery community to come together on a single platform, speak with one voice, and address common issues; to be a springboard for awareness-raising actions.

"Plastic Surgery originated from India and Sushruta is hailed by all as the founder of plastic surgery. Now we can also be proud that from India we conceptualised World Plastic Surgery Day," said Dr. Sabapathy, Chairman, Division of Plastic Surgery, Hand Surgery, Reconstructive Microsurgery and Burns at Ganga Hospital, Coimbatore.

He said the day was created to spread awareness of areas where plastic surgeons can play a great role but are often missed due to lack of awareness. Some such fields were diabetic foot ulcers where a contribution by a plastic surgeon can prevent amputations and lymphedema (elephantiasis) where they can help to reduce the size of the legs, he said.

Typically, cosmetic procedures include augmentation mammoplasty or reduction mammoplasty (breast enlargement or reduction), rhinoplasty (reshaping the nose) and liposuction, which is an increasingly popular method of fat removal from certain parts of the body. A plastic cosmetic surgeon is a specialist plastic surgeon who has mastered the art of performing exclusively cosmetic surgery as well. They can do reconstructive surgeries as well as reshaping procedures as well.

The "Your Health of IMA" is a publication of Indian Medical Association (IMA) for the masses from Kolkata. This July 2022 issue is dedicated to Sushruta-The Father of Plastic Surgery on World Plastic Surgery Day. The different authors have done a marvellous job while composing the contents covering a vast field in Medicine. I am grateful to all concerned those who have contributed to bring out this issue. I hope this will be of great help to the common masses to understand the subject.



**Prof. Dr. Prasanta Kumar Bhattacharyya**

PROF.&HOD, Dept Of Plastic Surgery, KPCMCH, Kolkata.

## Overview of Plastic Surgeries in India

The term "plastic surgery" originates from the Greek word "plastikos," which means to mold or shape.

Sushruta is considered the "Father of Plastic Surgery." He lived in India sometime between 1000 and 800 BC, and is responsible for the advancement of medicine in ancient India.

Plastic Surgery is a type of surgical specialty which helps to reconstruct or repair the parts of the body. It is done by the transfer of the tissues to the injured part of the body or for cosmetic purposes. This helps to modify the appearance of the patient.

The field of Plastic Surgery can be broken down into two main categories – reconstructive procedures and cosmetic procedures. Both are generally considered sub-specialties of plastic surgery.

**Reconstructive plastic surgery** Reconstructive surgery is performed to restore function and normal appearance, and correct deformities created by birth defects, trauma or medical conditions including cancer. Examples include cleft lip and palate repair, breast reconstruction following a lumpectomy or mastectomy for breast cancer, and reconstructive surgery after burn injuries. Typically, reconstructive surgery is considered medically necessary and is covered by most health insurance plans.

### Cosmetic plastic surgery

Cosmetic surgery is performed to enhance overall cosmetic appearance by reshaping and adjusting normal anatomy to make it visually more appealing. Unlike reconstructive surgery, cosmetic surgery is not considered medically necessary. Breast augmentation, breast lift, liposuction, abdominoplasty (tummy tuck) and facelift are popular examples of cosmetic surgery procedures.

Plastic surgery research encompasses a wide range of topics. Because it would be a difficult task to update all related subjects in limited space, we focus here on several specific areas and highlight recent advances and the methods by which they were achieved. With this in mind, we first discuss two areas that may revolutionize the field of plastic surgery. Due to the overlap of topics in the volume, we limit the discussion

to the potential of gene therapy and tissue engineering in the field of plastic surgery research, and reference the other chapters for specific methods and techniques. We also discuss contemporary methods of conducting research in the area of craniofacial surgery, concentrating primarily on the different animal models, as they relate to cleft lip and palate repair and craniosynostosis. Where appropriate, advantages and disadvantages of the current procedures are discussed, providing insight into the "tricks and traps" of each methodology.

### Skin Grafts

A skin graft is a segment of dermis and epidermis that is separated from its blood supply and donor site and transplanted to another recipient site on the body. Survival of the transplanted skin graft requires a vascularized wound recipient bed. Graftable beds with adequate blood supply include healthy soft tissues, periosteum, perichondrium, paratenon, and bone surface that is perforated to encourage granulation tissue growth. Poor wound surfaces with inadequate blood supply include exposed bone, cartilage, tendon, implant, and fibrotic chronic granulation tissue. The wound must be free of infection and debris and interposed as a barrier between the graft and bed.

Skin grafts are classified in the following manner: autograft, self; allograft, other person; homograft, same species; and xenograft, different species. Partial-thickness skin grafts consist of the epidermis and a portion of the dermis and are called split-thickness skin grafts (STSGs). Full-thickness skin grafts (FTSGs) include the epidermis and entire dermis and portions of the sweat glands, sebaceous glands, and hair follicles. The STSG is harvested with a dermatome that can be adjusted for width and depth, usually in strips of 0.006- to 0.024-inch in thickness. The STSG can be meshed by cutting slits into the sheet of graft and expanding it. Meshed grafts are useful when there is a paucity of available donor skin, the recipient bed is bumpy or convoluted, or the recipient bed is suboptimal as with exudate. STSG can be taken from anywhere on the body; donor site considerations include color, texture, thickness, amount of skin

required, and scar visibility. The STSG takes readily on the recipient site, and the donor site reepithelializes quickly from the residual dermis. Its disadvantages are contracture over time, abnormal pigmentation, and poor durability if subject to trauma. The FTSG is removed with a scalpel and is necessarily small because the donor site must be sutured closed. Containing skin appendages, the FTSG can grow hair and secrete sebum to lubricate the skin, has the color and texture of normal skin, and has the potential for growth. In general, FTSGs are taken from areas at which the skin is thin and can be spared without deformity, such as the upper eyelids, postauricular crease, supraclavicular area, hairless groin, or elbow crease. The greater thickness makes the FTSG more durable than the STSG, but this thickness also means that the graft take is not as predictable because more tissue must be revascularized from the recipient bed.

The take of either type of skin graft occurs in three phases:

1. Plasmatic circulation, also called serum imbibition, during the first 48 hours nourishes the graft with plasma exudate from host bed capillaries.
2. Revascularization starts after 48 hours with two processes. The primary is neovascularization in which blood vessels grow from the recipient bed into the graft, and the secondary is inosculation in which graft and host vessels form anastomoses.
3. Organization begins immediately after grafting with a fibrin layer at the graft-bed interface, holding

the graft in place. This is replaced on postgraft day 7 with fibroblasts; in general, grafts are securely adherent to the bed by days 10 to 14.

Principles of plastic surgery and their application to hand surgery Sushruta, a Hindu surgeon in India around the first century, performed reconstruction of the nose using pedicled flaps from the face – either forehead or cheek. He described the operation as follows:

The physician should take the leaf of a tree the same size as the nose and apply it to the cheek in such a way that a stem is still adherent. Then he stitches the cheek with needle and thread, scarifies the stump of the nose and quickly but carefully places the flap in the nose. After the transplanted piece has grown, the stem is cut off. In like manner the flap might be turned up from the upper or lower arm and attached to the nose – with the arm over the head.

This description included the basic plastic surgery principles of precise patterning of the defect, preparation of the recipient bed, and the use of local and distant flaps, all which have had obvious applicability to soft-tissue reconstruction of the hand.

Another famed surgeon, Ambrose Paré (1510–1590), offered principles that allowed for optimal care of battlefield wounds, including the upper extremity: “to enlarge the wound for drainage; to remove bone splinters and foreign bodies from wounds; to control hemorrhage with ligatures; not to encourage suppuration; and to amputate through sound tissues.”





**Dr Milind S Wagh**  
Senior Consultant Plastic and Cosmetic Surgeon, Mumbai

## Availability of Cosmetic Surgery in India

Plastic Surgery is a vast and unique specialty, it literally deals with the entire human body from head to toe. It is also an ancient speciality with its origins in India, in the 6th century BC, attributed to the Indian sage Sushruta. The modern history of Plastic Surgery however dates back to the last 150 years or so. The specialty is further divided in subspecialties such as Burns care, Hand surgery, Maxillofacial surgery, Craniofacial surgery & Cleft lip and palate treatment, Microvascular surgery, Cancer reconstruction, Limb trauma surgery and Cosmetic or Aesthetic surgery. Other than the last named subspecialty, all the others are categorized under the broad umbrella of Reconstructive Plastic Surgery, that is surgery largely for restoration of function and form, following congenital deformities and deformities following trauma or cancer.

Cosmetic surgery or Aesthetic Plastic surgery (the two terms being interchangeably used), on the other hand, deals with improving one's external appearance aesthetically, using techniques that hide and minimize scars and sculpt / reshape the human anatomy as desired by the patient. The global history of Cosmetic surgery is barely 100 years old, starting with surgeons in Europe who devised the early techniques for reshaping the nose, reversing ageing and lifting sagging breasts or reducing heavy breasts. Its prevalence in India is however less than 5 decades old, though its popularity and spread is even more recent. In India, for a long time, Cosmetic surgery was in fact considered the preserve of only the Rich and Famous, it was often ridiculed as surgery only for purpose of vanity.

Hundreds of Plastic surgeons have been trained in many centres across our country since the early 1960s. It all started initially with a few pioneering Indian surgeons, themselves trained mostly under British Plastic surgeons who had gained tremendous experience in the field of Reconstructive Plastic surgery during the two World Wars working on the mutilating injuries to the face, body and limbs suffered by soldiers. On their return to India, these pioneers established academic departments and teaching centres in metropolitan cities in many states of the country, almost all Government or Municipal Hospitals and Colleges, where structured training was imparted

in the different subspecialties of Reconstructive Plastic surgery to the second generation of Indian Plastic surgeons in the 1970s and 1980s. Cosmetic surgery was neither known nor popular or even considered necessary to be trained for, in a poor developing country like the India of those days.

A few second-generation Indian Plastic surgeons ventured to go to the USA and Europe for further training as techniques in the entire spectrum of Plastic surgery underwent exponential expansion there. It was an exciting time for Plastic surgeons as there was a rapid development of new procedures for the surgical treatment of deformities and defects hitherto thought impossible to correct. It was there that some of these surgeons were first exposed and attracted to the field of Cosmetic surgery which was simultaneously gaining tremendous popularity. In those developed countries, a booming economy, stable jobs, comfortable living conditions and adequate financial savings had allowed the ordinary person to look beyond their basic needs. Besides the obvious glamour of the movie stars, the advent of television and the fashion industry had changed the onus towards appearance, towards looking good, towards the "Self". Now it was no longer only the rich and famous who had Cosmetic surgery - significant sections of even the ordinary middle class was demanding and undergoing cosmetic surgery to improve their physical appearance. This in essence was the natural cycle which an evolving materialistic society and culture goes through, as standards of living improve across its entire spectrum.

When these few freshly trained Cosmetic Plastic surgeons returned to India in the 1980s, some of them began to exclusively practise Cosmetic surgery, mostly to the upper classes and the moneyed in our country in different metropolitan cities. These patients were not only those in the glamour industry such as the movies and fashion but also those who had been exposed to Western culture and education. Some of the others trained abroad returned to work in both academic institutions as well as in private practice. They would do Reconstructive surgery in their teaching Departments and Cosmetic surgery in their private practice.

Cosmetic surgery in India for many years was solely the preserve of these few surgeons with both the demand

and supply limited to the upper echelons of Indian society. They closely guarded their skill sets in Cosmetic surgery and teaching in the subject, to the next generation of Plastic surgeons in academic institutions was almost non-existent. The economic strata of most patients visiting Government and Municipal Hospitals for treatment also did not encourage the development of Cosmetic surgery there, there was no demand, hence no training.

With industrialization, rapid economic growth, educational advances and increasing exposure to Western culture through films, TV & print media, it was only a question of time before India too, through the 1990s and 2000s, gradually metamorphosed in the same direction as the West. There was also a veritable explosion in the urban and semi-urban population, in the Indian MIDDLE CLASS. India today has a middle class of approximately 250 million, which is way more than the entire population of all but a couple of dozen countries around the world. Especially in urban India, the scenario has accurately duplicated what was mentioned earlier about western countries a couple of decades earlier. As standards of living have improved, the ordinary person has more disposable income and money to spend. Cultural influences, peer pressure, work environments, heightened awareness of self all have contributed to shifting the onus to assessing one's appearance and to thinking of self Body-image which is exactly what Cosmetic surgery helps to enhance.

As demand for Cosmetic surgery slowly grew in India in the 1990s, a few of the pioneering Cosmetic surgeons of the country came together to form a national body in 1996, the Association of Aesthetic Plastic Surgeons (IAAPS). This aimed at popularizing the subspecialty by creating awareness in the general public and training more Plastic surgeons adequately to serve the increasing demand. Today after 26 years, the membership of IAAPS is 700+ strong and growing rapidly. All its members are certified qualified Plastic surgeons with full-fledged training in the specialty and additional training in Cosmetic or Aesthetic Surgery. Its members practise not only in major metropolitan cities across India but even in tier II and tier III cities and towns in all states of the country.

In India today in 2022, the full spectrum of various procedures that constitute Cosmetic surgery are done by trained, qualified, experienced surgeons across the length and breadth of the country. It is absolutely not necessary for anyone in India to need to travel outside the country to undergo these procedures safely and with satisfactory results. The spectrum of Cosmetic surgery includes procedures such as :

- Rhinoplasties to reshape and recontour the nose, correct deviations, augment or reduce the nasal bridge, reshape the tip, reshape of the nostrils etc

- Anti-ageing procedures such as Face-lifts and Neck-lifts which tighten the excess lax skin and lift & reposition the drooping underlying tissues to restore a youthful refreshed look to the face and neck
- Procedures for rejuvenation of Upper and Lower eyelids, to remove excess and lax skin, fat bulges (eye-bags) and wrinkles known as Blepharoplasties
- Reshaping of the ear, known as Otoplasties for prominent or misshapen ears
- Reshaping of the upper and lower jaw using bone adjustment surgeries or using implants
- Hair transplantation for restoring hair in balding patients
- Surgeries on the breasts such as Breast reduction (for excessively large and heavy breasts), Breast Augmentation (for poorly developed breasts), Breast Lift (for sagging or drooping breasts) and Correction of congenital breast asymmetries and maldevelopments
- Surgeries for correction of abnormal gland and fat deposition in the male chest, a condition known as Gynaecomastia
- Body contouring surgeries such as Liposuction where excess fat is removed from different areas of the body such as the tummy, chest, hips, thighs and arms and thereby the body is contoured and reshaped
- Torso and Limb reshaping Surgeries that remove and precisely as well as meticulously tailor excess skin-fat from the Abdomen such as Tummy tucks (Abdominoplasty), Thigh lifts, Arm lifts and Body Lifts (following loose hanging skin after massive weight loss)
- Use of one's own fat for both augmentation and contouring in different areas such as the face, breast, hips, buttocks as well as for skin rejuvenation (using the restorative property of totipotent stem cells present in our body fat) known as Autologous fat transfer, an exciting and exponentially expanding advance in our field
- Genital Cosmetic surgeries for both men and women
- Non-surgical cosmetic treatments such as use of Fillers and Neurotoxins for various purposes
- Use of a wide variety of Energy based devices such as Lasers for a wide spectrum of cosmetic treatments.

It is vital to understand that doing Cosmetic surgery in all these areas of the body not only requires a full in-depth knowledge of human anatomy, understanding of blood supply and nerve supply to different parts of the body, ability to gently and carefully handle tissues but also a 3-dimensional perception of shapes and



contours as well as a sense of artistry. This is possible to acquire only with full-fledged extensive training in Plastic surgery, a 3 year degree (M.Ch) or diploma (DNB) super-specialty course which is itself only possible after a previous rigorous 3 years post-graduate training in General surgery (MS or DNB) and a 5-6 years basic medical training towards an MBBS degree. Therefore, by the time a person becomes a qualified Plastic surgeon trained to do these procedures, he/ she has 3 bonafide degrees and has studied Medicine for more than 10 years and worked with patients for at least 6 years.

Further training in Cosmetic surgery is acquired through fellowships, training courses and Continuing Medical Education (CME) programs held by the national association (IAAPS) in different centres across the country. The global Aesthetic Surgery body, known as the International Association of Aesthetic Plastic surgeons (ISAPS) with members from more than a hundred countries around the world also holds regular courses and symposia in India to impart training in the latest techniques and innovations, only to certified and qualified Indian Plastic surgeons.

As awareness and demand have increased across all social classes in India in the 21st century with better literacy and more ordinary people wish to have Cosmetic surgery to enhance their appearance, teachers and trainees in teaching Depts in many Government / Municipal hospitals across India have also gained experience in Cosmetic surgery procedures since they now have a regular flow of such patients in their hospitals as well. This is a wonderful development and has helped significantly in spreading the word about the safety and benefits of Cosmetic surgery to more and more people in our country.

For many years and to some extent even now, there is a myth and belief that Cosmetic surgery is very expensive and unaffordable to all but the well-off. This is certainly not true. Most major cosmetic surgery procedures cost around as much as any General surgery, Orthopaedic surgery, Gynaecological surgery or Urological surgery procedure. They certainly do not cost as much as Cardiac surgery or Neurosurgery. Since this is surgery that patients themselves seek, in order to enhance their self-image and self-confidence and since the result is quite often transformative, the cost to benefit ratio is most definitely in the patient's favour.

In the last few years, due to a) the rapidly expanding demand for Cosmetic surgery, b) the grossly wrong perception that it is easy to do and c) the greed and lure of money, it was inevitable that our field would attract the attention of many totally unqualified and untrained people as well as a few colleagues from other specialties which have no direct connection with Plastic or Cosmetic surgery nor the requisite training in

their curriculum. They promise the sun, the moon and the stars, often at bargain prices, and usually without proper assessment of the patient and of course without the requisite skill and training. Many laypersons who seek Cosmetic surgery for themselves or their kin unfortunately are fooled and trapped by these untrained and unqualified people, often with disastrous results and horrifying complications. The general public must be made aware and warned of such unscrupulous practitioners to make sure that they are not misguided.

Unsatisfactory results and minor complications in surgery are rare in the hands of qualified and trained Cosmetic surgeons. However, unfortunately a few may occur in spite of the best treatment or skill since we are dealing with the complexities of the human body. It is important for the prospective patient to understand that the training and knowledge that qualified Plastic and Cosmetic surgeons have, also helps in dealing with these untoward sequelae and complications so that the patient can have a final satisfactory result, if they occur.

A visit to the official website of IAAPS, [www.iaaps.net](http://www.iaaps.net), can provide anyone access to the details of qualified and trained Plastic surgeons in different parts of the country, categorized by states and cities and towns where they practice, to check their qualifications and credentials so that they know whom to approach safely for their cosmetic surgery needs. You will definitely find a good, well-trained Plastic and Cosmetic surgeon in your own city or town or close-by to consult and have your surgery with, safely and to your satisfaction.

In summary, cosmetic surgery is elective surgery that patients seek, to improve their appearance as per their individual concerns and desires. It can be transformative and completely change a person's life for the better. The enhancement of self-image and self-confidence that well-planned and properly done cosmetic surgery achieves can be truly amazing. The safety of the procedure and the benefit to the patient versus the risks are the foremost guiding principles that trained Plastic and Cosmetic surgeons keep in their mind at all times. There are now enough trained and qualified Plastic and Cosmetic surgeons across the length and breadth of India to serve the needs and concerns of patients who wish to undertake this still rapidly expanding and exciting branch of Plastic surgery. Patients seeking Cosmetic surgery must check the qualifications and credentials of the doctor they visit and make sure he's a trained and expert professional - there itself, half the battle is won in their desire to obtain a satisfactory and pleasing result from their Cosmetic surgery.



**Dr Padam Singh Bhandari, M.B.B.S., M.S., MCh (Plastic Surgery)**  
 Consultant Plastic surgeon & Professor, Dept of Burns and Plastic Surgery Lok Nayak Hospital  
 and associated, Maulana Azad Medical College, New Delhi

## Ear reconstruction

External ear is not prominently placed on the face as the nose is but it certainly has its aesthetic value. It is meant to be flaunted and adorned. Ear piercing is routine in all parts of the world with a range of jewelry pieces concentrating in enhancing its natural beauty. Women adorn their ear with variety of ornaments. With changing trend in fashion technology, now a days even men are getting their ears pierced. Persons with deformed ears have to limit their range of hair styles. Hence there is a definite need to reconstruct the deformed ear in both sexes.

Total ear reconstruction is one of the most difficult problem faced by a plastic surgeon because of multiple stages of reconstruction, prolonged hospitalization and high cost. Multiple staged reconstruction makes it prone to complication. Even a small complication at any stage can completely change the total outcome in ear reconstruction. It needs total dedication, long experience, artistic skill and high level of craftsmanship to carve out an ear frame work out of costal cartilage. This is difficult to achieve. With the pioneering work of Tanzer, Brent, and others great advancements have been made in ear reconstruction.

Two basic raw materials which are required for ear reconstruction are: 1. Framework 2. Draping skin/ Cover

**Framework:** Quality framework made up of silastic and porous polyethylene (Medpor. Porex, College Park, are available in the market. Cronin et al used a commercially available silastic framework for ear reconstruction with good results. But its use has gone down tremendously because of high incidence of infection and extrusion. Polyethylene framework is a new material and have shown promising results. The porous polyethylene framework becomes rapidly vascularized with soft tissue in growth and collagen deposition. But, long follow up and more work is required to established it as a viable alternative to costal cartilage for ear framework which is the choice of tissue for ear reconstruction. Although, in patient who have calcified rib cartilage or in patients with inadequate costal cartilage, porous polyethylene can be a viable alternative for ear framework. But the choice of framework in ear reconstruction is



autogenous costal cartilage. Being autogenous in nature, chances of exposure, extrusion and infection are minimal in autogenous costal cartilage. The only disadvantage being, it requires an expert who can do a quality fabrication work.

**Draping Skin/Cover:** Cover to be used for framework depends upon the quality and quantity of skin available in the auricular region. If the skin in the auricular region is healthy (which is usually the case in congenital ear deformity cases), then it is the choice of the tissue to be used as cover for ear framework. If the skin in the auricular region not of good quality due to scarring (usually the case in post burn and post traumatic cases) then the temporoparietal facial flap is used to cover the framework.

The ear is approximately 85% grown by the age of 4 years so theoretically ear reconstruction can be started at the age of 4-5 years, but the author is of opinion that it should be deferred till the age of 10 years when sufficient costal cartilage is available for quality framework fabrication.

**Brent's Technique:** Ear reconstruction is done in four stages. In the first, stage ear framework is implanted in the auricular region. In the second, stage congenitally



displaced lobule is placed in alignment with reconstructed auricle. In the third stage, ear framework is elevated from the scalp. In the fourth, stage external auditory meatus and tragus is reconstructed.

Preoperative planning is extremely important and an essential step in ear reconstruction, where the following plan is formulated (1) the size, shape, and site of the ear to be reconstructed; and (2) the type of cover available for draping of the ear framework. The size and shape of the ear to be reconstructed are decided with the help of a template made up of a plain radiographic film tracing of the normal ear. Two templates are made; one helps in cartilage framework fabrication and the others helps in deciding the size and direction of the ear.

The ear is reconstructed around the external auditory meatus if it is present. Otherwise, the location of the ear is decided with the help of following points:

1. External auditory meatus is placed just posterior and at the same level to that of the temporomandibular joint.
2. A point is marked at the angle of the mandible. A vertical line is drawn through this point. The ear is placed posterior to this line.
3. Distance between outer canthus of the eye and crus of the helix of the normal ear is measured. This distance is taken over to the measured. This distance is taken over to the deformed side and a point is marked for the crus helix of the ear to be reconstructed.
4. Upper margin of the ear is kept at the same level as that of the normal ear in unilateral deformity and to the level of the eyebrow in cases of bilateral deformity.

The orientation of the ear is decided by the direction of normal ear. In bilateral deformity of ear, it should be placed 15 to 20 degrees more vertical to the axis of nose.

Skin cover to be used for coverage of cartilage framework is decided by the condition, quantity and quality of skin available in and around the auricular region.

### Surgical Procedure

#### Stage 1

Framework fabrication: A horizontal incision is made just above the costal margin. The synchondrotic portion of the sixth and seventh ribs is taken with an extra perichondrial dissection to obtain an unmarred specimen and is used to reconstruct the basal framework. Eighth rib is taken to reconstruct the helical margin. With the help of a template, cartilage

fabrication is carried out. Brent uses nylon to hold the pieces together during fabrication of framework from costal cartilage.

**Framework Insertion:** If the skin in the auricular region is normal, then a thin cutaneous pocket is created in the normal postauricular skin through a small incision at the middle of posterior margin of external meatus. The framework is introduced after securing absolute hemostasis. Skin is coapted to the framework with the help of a suction catheter. If the skin in the auricular region is scarred then temporoparietal fascial flap based on superficial temporal artery and vein is raised. Fascia is turned down and is wrapped around the cartilage framework. The fascial flap is co-opted to the cartilage with the help of a suction catheter and is covered by split-thickness skin graft.

In the post operative period, suction drain is taken out on the third postoperative day and dressing is changed on the seventh postoperative day. During the postoperative period, the delicate contours of reconstructed ear are quite often masked as a result of prolonged edema, thick draping skin, larger than required temporoparietal fascial flap, organized hematoma, or inflammatory exudates. In most of the patient's edema subsides within 6 to 8 weeks of operation and ear contours begin to show through the skin.

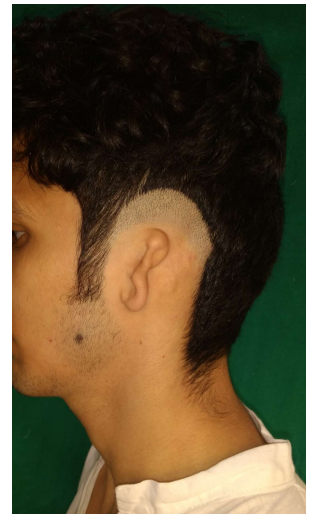
During the first stage, an extra piece of rib cartilage is banked underneath the chest incision or underneath the scalp posterior to the cutaneous pocket of the framework. This wedge shaped cartilage is placed behind the elevated ear for projection of the reconstructed auricle in the second stage.

#### Stage II

This involves recreating or reposition of the lobule. If lobule is present but out of alignment, it is merely realigned with the reconstructed ear. If reconstruction of lobule is required, several techniques have been described. Zenteno Alanis and Feldman have useful techniques for lobule reconstruction. It is also possible to use cartilage to support the constructed lobule.

#### Stage III

In this stage, implanted cartilage is elevated from the scalp and full thickness graft from groin or thick split thickness skin graft from thigh is applied over the resulting raw area.



#### Stage IV

The tragus is created by harvesting a composite chondrocutaneous graft from the contralateral auricle's anterolateral conchal surface and placing the elliptical graft beneath a J-shaped incision in the conchal region. The concha is deepened by removing soft tissue beneath the tragal flap.

Projection of the reconstructed auricle is accomplished using a wedge of rib cartilage behind the elevated ear. During the first stage, an extra piece of rib cartilage is banked underneath the chest incision or underneath the scalp, posterior to the cutaneous pocket of the framework

#### Nagata's Technique

In this technique ear reconstruction is done in two stages

In the first stage sixth to ninth costal cartilages are harvested for fabrication of ear framework. Cartilages are taken out by subperichondrial dissection preserving perichondrium on both the sides. Basal framework is constructed by sixth and seventh costal cartilages. The eighth rib is placed over basal framework to construct the helical rim unit and the crus helicus. The ninth rib makes the antihelix, superior and inferior crus. The conchal bowl pieces are derived from rib cartilage remnants. Tragus is constructed in the first stage itself. Nagata prefers the use of fine-gauge wire to hold the construct together. After the cartilage harvest sub-perichondrially, perichondrial pocket is made and the left over cartilage pieces are cut into 2 to 3 mm blocks. These small pieces of cartilages are placed back in the perichondrial pockets to prevent chest wall deformities.

The next step in the first stage is coverage of the framework in the subcutaneous pocket with incisions in the shape of a "lazy W." The lobule is split to form anterior and posterior skin flaps. The posterior lobule flap remains attached to the mastoid skin flap, while the anteriorly based tragal flap is sutured to surface the external surface of the tragus

**Second stage :** In the second stage. A skin incision is made 1 cm posterior to the helix. Reconstructed ear is elevated from scalp. A crescent shaped wedge of rib cartilage is harvested from the fifth rib and is placed under the ear to create projection of the reconstructed framework. A temporoparietal fascia flap is raised and is turned down to cover the raw posterior surface of the ear as well as the newly harvested cartilage projection graft and the mastoid skin. Retroauricular skin is advanced anteriorly and a full-thickness skin graft should be used to cover the remaining raw areas

Chest wall deformities are prevented by preserving the perichondrium at the donor site.

Total ear reconstruction is a difficult problem, but if the following points are heeded, success can be achieved in most cases:

1. Careful preoperative planning to decide size, site, direction of ear, and cover to be used for ear framework.
2. Use of autogenous costal cartilage for reconstruction of ear framework.
3. During framework fabrication, triangular fossa and scapha should be made as wide and as deep as possible to leave room for draping skin. Otherwise, the draping skin fills the grooves and masks the contours.
4. Helical and conchal augmentation by a cartilage strip should be done.
5. Skin pocket should be of adequate size. Otherwise, tight skin tents over the contours leaving a dead space for blood to collect, leading to masking of the contours.
6. While making a skin pocket, skin should be raised as thin as possible so that it drapes well over the contours of reconstructed ear. At the same time it should be thick enough to survive.
7. The temporoparietal fascial flap should be of optimum size, neither too small nor too large.
8. Absolute hemostasis should be achieved.
9. Antiseptic and aseptic precautions should be taken.
10. No bolster suture should be used for coaptation of skin temporoparietal fascial flap.
11. Triamcinolone acetonide injection should be used in case of masking contours.
12. Take care to avoid exposure of cartilage while raising it from the scalp in stage III

The aim in ear reconstruction is to achieve an ear that does not attract attention from peer group.

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*Continued on page 16...*



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Liposuction is a term commonly used for suction assisted lipectomy of subcutaneous fat and is one of the commonest aesthetic procedures in the world for body contouring. Introduced by Illouz<sup>1</sup> in 1980, it has undergone various technical modifications with technological advancement. It must be understood that it is not a method of weight loss but a process for body contouring. However, those who maintain a proper diet and exercise regimen, weight loss is an additional benefit. It is now a procedure applicable for contouring many parts of the body viz. face, neck, chest back, arms, abdomen, buttocks, thighs and legs.

Unlike descriptions in anatomic text books, subcutaneous fat is considered to exist in three layers viz. superficial, intermediate and deep<sup>2</sup>. While superficial fat consists yellow small globules, the deep fat is loose areolar, whitish yellow and consists of large globules. Intermediate layer is a transition between the two. For cosmetic purpose, intermediate and deep layers are targeted, superficial layers are touched mainly for enhancing contour. The subcutaneous tissue in the back, hips, thighs and legs contain more of fibrous element.

The essential equipments for liposuction are:

1. A machine creating a negative pressure with tube connected to the cannulas.
2. Various tapering blunt nosed cannulas usually between 1 and 4 mm in diameter and 10 and 30 cms in length with multiple apertures.
3. Syringes with fitting cannulas use for small areas of liposuction and harvesting of fat for injection

#### Procedure

On an average 10% of the body weight in litres has been found to be a safe amount of lipoaspirate although megaliposuctions amounting to 20 litres of lipoaspirate are also possible in suitably selected patients. Large liposuctions are usually undertaken under general anesthesia with tumescent technique<sup>3</sup> which means the tissue in the area to be sucked is made turgid by infiltration of fluid containing either Normal Saline or Ringer-lactate – 1 litre

Adrenaline (1 in 1000) – 1ml

2% Lignocaine – 30 – 50 ml (as per different formulae)

8.4% sodium bicarbonate – 12.5 ml and Hyaluronidase are optional but used by some.

Other types of liposuction viz. dry (not used), wet, super wet depending upon the proportion of fluid injection exist, but less commonly used. There is a controversy in infiltrating lignocaine despite general anesthesia but most surgeons use it.

After waiting for about 10 minutes for the tumescent solution to act, liposuction is started through small stab incisions in preferably hidden places or natural folds. The movement of cannula is usually crisscross and fan shaped with smooth gradual movements carried out with the dominant hand. The other hand feels the aspiration taking place ensuring at the same time that tip and distal end of the cannula doesn't become too superficial. The end point is decided by pinching the skin and feeling the amount of subcutaneous fat that is to be left behind. Post operatively pressure garments are applied, to be used for about a month

Modifications to traditional liposuction:

1. Power Assisted liposuction (PAL)<sup>4</sup> – Externally powered canula which oscillates in a reciprocating motion is used. It reduces the fatigue of the surgeon and has the advantage of working better in areas of fibrous fat and revision liposuction. The equipment is a bit heavy and vibration poses problem for the surgeon.
2. Ultrasound assisted liposuction (UAL)<sup>5</sup> – Here, sound waves are transmitted through tip of cannula. Mechanism is primarily mechanical but cavitation and some production of heat occur. Emulsification of fat eases the process of suction while fibroseptal connection between skin and muscle fascia are left intact. This method helps in skin contraction and there is much less bruising but cavitation, increased seroma and edema may be a problem particularly if one is inexperienced. VASER is a newer version of UAL device incorporating less energy.
3. Laser assisted liposuction (LAL)<sup>6</sup>: Instead of sound

energy, laser energy is transferred to tissue from the cannula or a separate fibre in the form of heat to disrupt fat cell membrane and emulsify fat. It also helps in skin retraction and causes less bruising and pain. However, thermal damage of skin is a possibility.

#### Complications:

Pain, bruising, ecchymoses are common but transient. These are much less with ultrasonic or laser assisted liposuction.

Disorder of fluid balance and hypothermia are to be avoided at all costs.

Cosmetically devastating complication of skin necrosis is a result of too superficial liposuction. It can also occur with energy based devices.

Injury to abdominal viscus with cannulas though rare, has been reported.

Contour irregularities with bumps and depressions is a common complaint particularly with initial attempts and less experience.

The most dangerous complication is fat and pulmonary embolism and may require intensive therapeutic intervention. Death has been reported following liposuction presumably from embolisms.

Increased complications are reported particularly when liposuction is combined with other procedures like abdominoplasty.

Newer non surgical methods of lipoplasty<sup>7</sup>

These devices are more market driven because of the demand for non surgical methods of reduction of fat. All these devices destroy fat and depend on body's macrophage system to remove them. Transcutaneous energy is delivered by these devices in the form low laser, ultrasound, radiofrequency, tissue cooling, physical massage. Though attractive in theory and

some approved for therapeutic effects, large scale scientific studies are not yet available.

Dissolution of fat by deoxycholic acid is not new but mentioned for completeness of listed procedures. It has limited application.

#### Conclusion:

Liposuction or suction assisted lipectomy is a very popular armamentarium in plastic surgery for body contouring and its number is increasing every year. With the use of tumescent anesthesia and proper patient selection, it gives excellent results. Use of newer energy based devices has made it less tiring for the surgeon with additional benefit for more skin retraction and better cosmetic results.

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## Ear reconstruction

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## Plastic Surgery – What is it All About?

Plastic Surgery today faces an identity crisis because of the vastness of its scope. Whether it is the surgery of visible birth defects or cosmetic blemishes like scars, white or dark patches, obesity, baggy eyelids, baldness and so on, treatment of burn and burn scare, surgery of the hand and feet, surgery of cranio-maxillofacial skeleton and soft tissues, reconstructions after ablative cancer surgery or treatment of tropical diseases like filarial elephantiasis, everything is addressed by a plastic surgeon. So why, despite our virtual omnipresence we are not recognized? Why is it that the common man feels that we are the guys who attend to the noses, breasts and bums of the actresses and are an elitist lot? Why is it that not only the lay man on the street but even our own colleagues do not know about the scope of our speciality? And who should be held responsible for our imprecise and blurred existence?

We are not a new speciality

On the contrary, we are the oldest speciality of surgery and even as early as in 600 BC the first surgeon on earth, Sushrut, practiced the surgery of reconstructing cut noses using cheek tissue in the oldest living city on earth, Kashi. So, if we have this glorious history to boast why are we in cross roads today?

The factors responsible for this confusion and this malady are both intrinsic, because of what we are and extrinsic, because of what we are perceived to be. Let me take up the intrinsic factors first.

1. The first confusion is in the word 'Plastic' in our name. No, we do not use plastic, though we use a lot of implants today made of titanium or silicone in bones, breast, pectorals and calf. The word "Plastic" comes from the Greek word 'plasty' which means to form or to create.
2. We do not cater to any special age group like the Paediatricians or the Geriatricians, we treat patients of every age group from newborns to the elderly.
3. We do not address the problems of any particular gender like the Gynaecologists or the Andrologists
4. We do not treat any particular disease like the Oncologist, Diabetologist or the Rheumatologists
5. We do not have any organ or any system to our

name like the Urologists or the Neurologists. Because of all these reasons it is very difficult for the lay man and also at times the referring doctors to know who we are and what we do.

To some extent our undergraduate training is also responsible. It has no national standardization and so what is being taught to the UGs is so variable that many undergraduate students never come to know about Plastic Surgery. Particularly in those Medical Schools which do not have a Plastic Surgery Department, the students are never exposed to our speciality. And these are the fellows who are going to do general practice in their communities tomorrow. Once they are registered by the Indian Medical Council they need no further training, CME, degrees and they are licensed to practice within their intellectual limitations for life. Remember, what the mind does not know the eyes do not see!

Now if this existence in the vacuum of ignorance was limited to the fellows doing MBBS only it would have still not been all that bad. Imagine what is happening with all those who go on to do their Post Graduation. If that is not in any Surgical speciality they will never know what we do, particularly if their College does not have our Department. Even if it has a Department of Plastic Surgery, the question arises are the fellows doing MS in General Surgery, Orthopaedics, ENT and Maxillofacial Surgery ever having a proper surgical rotation through Plastic Surgery? Are they? All of them? I don't think so! I was in the Universiti Sans Malaysia recently, a very young University when compared to ours. They had the vision for such a rotation, for all of the allied specialities. What is stopping us from doing so?

Scope of Plastic Surgery:

Plastic Surgery has today touched a wide variety of people and is certainly within the easy reach of everyone. The services we cater in Plastic Surgery can be broadly summarized under the following headings:

1. Birth defects of Congenital anomalies
2. Cosmetic disfigurements
3. Burns and its sequel
4. Surgeries in the hands and feet
5. Reconstruction following Cancer surgery or Onco-plastic

6. Trauma
7. Cranio-Maxillofacial Surgery
8. Oculoplastic Surgery
9. Microsurgery
10. Anti aging

Let me briefly elaborate each of them:

1. Birth Defects
  - Cleft Lip, Cleft Palate
  - Rare clefts
  - Hypospedias, Epispedias and Extrophy
  - Syndactyly, Polydactyly and Club hand
  - Bat ear, Skin tags
  - Cystic Hygroma
  - Dermoids, Branchial Cysts and Thyroglossal Cysts
2. Cosmetic Disfigurements
 

**Face & Head**

  - Baldness – male and female pattern
  - Acne and Pox marks
  - Scars from injury and surgery
  - Vitiligo and Pigmented patches
  - Wrinkles and folds
  - Rhinoplasty – aesthetic improvement of nose
  - Genioplasty – aesthetic improvement of chin profile
  - Vascular malformations

**Breasts**

  - Breast Augmentation – for small breasts
  - Breast reduction - for large breasts
  - Breast lift – for loosely hanging breasts
  - Breast reconstruction – after mastectomy in cancer patients
  - Gynaecomastia

**Abdomen**

  - Liposuction
  - Abdominoplasty
  - Incisional hernia surgery
  - Scar revision of Caesarian scars
  - Body contouring surgery

**Limbs**

  - Liposuction
  - Dermo-lipectomy
  - Filarial elephantiasis
3. Burns
  - Fresh burns – thermal, electrical, chemical
  - Post burn contractures, deformities and disfigurements
  - Post burn scars and white patches
4. Surgery of Hands and Feet
  - Birth defects
  - Hand injuries – soft tissue and bone
  - Amputations of limbs and digits for replantation
5. Reconstruction after Cancer surgery
  - Farm accidents and thresher injuries
  - Industrial accidents
  - Road traffic accidents
  - Nail bed injuries
  - Hand and foot tumours of soft tissue and bones
  - Hand and foot burns
  - Hand and foot contractures and deformities
6. Trauma
  - Head & Neck cancers
  - Breast cancer
  - Parotid cancer
  - Skin cancer
  - Genital cancers
  - Ano-rectal cancer
  - Bone tumours – for limb salvage
  - Jaw tumours
7. Cranio-maxillofacial
  - Hand injuries
  - Foot injuries
  - Fractures in the face and jaws
  - Long bone fractures with soft tissue loss
8. Trauma
  - Facial fractures
  - Tumours of face – Haemangioma, cancers
  - Oral cancers and Skull base tumours
  - Cranial and facial congenital anomalies
  - Temporo-mandibular joint diseases and ankylosis
  - Craniostenosis
  - Hypertelorism
  - Surgery for malocclusion- orthognathic surgery
9. Oculoplastic surgery
  - Blepharoplasty – for baggy eyelids
  - Orbital fractures
  - Enophthalmos – sunken eyes
  - Exophthalmos – bulging eyes
  - Orbital tumours
  - Eyelid tumours
  - Surgery for dry eyes
  - Pigmentations and wrinkles around eyes
10. Surgery of Aging face
  - Blepharoplasty – for baggy eyelids
  - Face lift – for aging face
  - Neck lift – for loose neck folds
  - Crow feet wrinkles and jowls
  - Double chin
  - Non-surgical facial rejuvenation with chemical peels, lasers, botox, fillers and threads
11. Microsurgery
  - Replantation surgery for amputated limbs, digits, ear, scalp
  - Revascularization of incomplete amputations
  - Peripheral nerve injuries
  - Brachial Plexus injuries

- Peripheral vessel injuries
- Free tissue transfer
- Composite tissue allotransplantation
- Surgery for infertility – tubal recanalization, vas recanalization

11. Others / Miscellaneous

- Pressure sores
- Vesicovaginal fistula
- Hydradenitis
- Hernias

The most important feature of Plastic Surgery is that it is a common pool of surgeons which can help the general surgeon with his incisional hernia repair, gynaecologist with his vesico-vaginal fistula, cardiologist with his infected pacemaker, surgical oncologist with his post ablative soft tissue and bony reconstruction and orthopaedic surgeon with his

compound fractures in limbs.

The Government too should realize that in today's day and age all Government hospitals and medical colleges should have a Plastic Surgery department, not only to cater Plastic Surgery to the masses but to augment the facilities of other specialities. Thus an Orthopaedic surgeon will give better results in trauma, an Oncologist will offer better reconstructions to his/her patients, a gynaecologist will get better results of their infertility surgery, and a rehabilitation center will manage bed sores better if they have a Plastic Surgery department to boost their facilities. Till that day we Plastic Surgeons will be distinctly lucky if the man on the street does not think that we are making plastic noses and fingers and the family doctor considers us to be an elite species catering only to the rich and influential!



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Rhinoplasty is a cosmetic procedure for changing the shape of the nose to make the nose beautiful. Though the concept of beauty changes according to race and region. It is commonly known as Nose Job.

Rhinoplasty can be surgical, non surgical and reconstructive.

Rhinoplasty is a most commonly done procedure in the field of cosmetic surgery and at the same time highest number of litigations have been filed for this procedure.

**Augmentation** :Augmentation or increasing the height of the nose is the most commonly done procedure in this part of the world. Augmentation can be done with bone, cartilage (rib cartilage or ear cartilage), silicone, medpor. Cartilage may be given as a single piece or as diced form. Previously the diced cartilage was used after wrapping in a fascia (temporal fascia), now a days many surgeons are using free diced cartilage. Bone can be taken from iliac crest but as the chance of absorption is high it is not a preferred choice. Taking of bone and cartilage leads to a second scar at the donor site. Silicone augmentation is a fashion now a days as it is easily available and it avoids the donor scar for cartilage and bone graft. As silicone is a foreign material, the chances of extrusion is very high so there are many surgeons who do not prefer silicone implant for nose. Medpor is a high density porous polyethylene implant. Tissue grow into the porous structure so taking out the implant become difficult if necessary. So finally cartilage is the best material for augmentation.

**Correction of broad nose**: this is also a very demanding procedure in this part of the world. Correction of broad nose needs osteotomy. Osteotomy is done along the naso facial junction, the bone is cut along the junction of nasal bone and maxilla. There are different types of osteotomy like lateral, medial, transverse etc to give the desired shape to the nose. Thus the nose become narrow after the osteotomy.

Role of septum is very important in rhinoplasty. Preoperative assessment of septum is very important. If there is any deviated septum it should be corrected otherwise after rhinoplasty there will be narrowing of the airway due to osteotomy and gross functional

problem.

**Correction of deviated or crooked nose**:nobody likes a deviated nose or a crooked nose. Again cutting the bones or osteotomy is needed to correct the deviated nose. Septal correction or septoplasty is also necessary for correction of the deviated nose. So both the deviated septum and the deviated nasal bones to be corrected to give a straight nose.

**Tip correction**:tip of the nose is formed by two lower lateral cartilages. By different types of stiches and supporting graft,shape of the tip can be altered. Diverged domes of both the lower lateral cartilages are brought to the midline by inter cartilaginous stiches to give a narrow tip.

**Alar correction** : broad ala can be corrected by excising a measured portion of the ala.

**Hump removal**: some people do not like their nasal hump. Hump may be bony or cartilaginous. Upper portion of the nose is bony and the lower portion is cartilaginous. Small bony hump may be reduced by rasping and large bony hump need removal of some portion of bone. Cartilaginous hump may be reduced by cutting with scissor or scalpel. After removal of hump there may be some irregularity over the dorsum of the nose which may be managed by free diced cartilage.

**Age** :rhinoplasty is preferably done after 18 years age but limited rhinoplasty may be done before 18 years. Paediatric rhinoplasty is also coming up but bony work should be done at a later age.

**Postoperatively splinting** is done for a few days to maintain the shape of the nose.

**Non surgical rhinoplasty**:is mostly done by fillers most commonly hyaluronic acid. These fillers are used to alter or change the shape of the nose. Fillers may be used to augment or increase the tip projection of the nose. It is also called injection rhinoplasty as fillers are given by injection. It normally lasts for six to ten months. After that the process has to be repeated so it is temporary.





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## Management of adult brachial plexus injuries

### Introduction

A brachial plexus injury is usually sustained in high speed motor bike accidents and manifests as an impairment of motor and sensory functions in the affected upper limb. These injuries occur in approximately 4.2% of motor cycle accidents. Other less common modes of injury include automobile accidents, falls, sports injury, bicycle and pedestrian accidents, stab and gunshot wounds, inflammation (Brachial neuritis or Parsonage Turner syndrome) and compression by tumors. The magnitude of injury may vary in severity from a mild stretch to the nerve root avulsion from the spinal cord. There is a lack of knowledge, not only in general public, but also amongst most of the clinicians, about the recent developments in this field of trauma care. Just a few decades back there was no treatment for these injuries and painful and functionless arms were even amputated. With the introduction of microsurgical techniques it is now possible to restore a functioning limb in many of these patients. Functional outcomes depend on the type of injury, time of surgical intervention, age of the patient and adherence to postoperative physiotherapy protocol.

### Background and history

The first mention of brachial plexus injury finds its place in the eighth book of Homer's Iliad. A case of surgical repair was described in 1900 by Thorburn. Attempts were made in repair of missile induced brachial plexus injuries during World War 1 and 2. However surgical attempts failed to generate much enthusiasm. The advances in microsurgery in late 1960's and 1970's, and the pioneering work on peripheral nerve surgery by Millesi<sup>1</sup> and Narakas<sup>2</sup> witnessed newer horizons in the years immediately thereafter. Subsequently, Allieu, Samii, Brunelli, Yeoman, Alnot and other workers published their experience with nerve transfer, nerve grafting and direct muscle neurotization in 1980's<sup>3</sup>. Since then new techniques and nerve transfers reported by C Oberlin<sup>4</sup>, Somsak Leechavengvong<sup>5</sup> and others have gained wide acceptance and have resulted in improved outcomes.

### Patient evaluation

Brachial plexus injuries are usually traction induced injuries from high speed motor bike accidents. Majorities of the injuries fail to recover spontaneously and require microsurgical intervention. These injuries usually occur in the setting of a poly trauma syndrome. Neurological examination becomes difficult in an unconscious patient and this delays the diagnosis of a brachial plexus lesion. Clinical examination sometimes helps in the localization of lesion. An associated Horner's syndrome (Fig 1) indicates a partial or complete avulsion of C8 and or T1 spinal roots. Severe deafferentation pain in the extremity indicates possible lower root avulsions.

The British Medical Research Council (BMRC) grading system is used to measure the motor strength of each muscle. Sensory examination is performed using two-point discrimination or Semmes Weinstein monofilament testing.

In upper arm type injury (C5, C6) shoulder and elbow functions are poor however hand functions are preserved. With C5,6,7 injury there is an additional weakness in wrist and finger extension. Lower brachial plexus palsy (C8-T1) presents with poor hand functions and normal shoulder and elbow functions. In total palsy whole limb is flail and insensate

Paralysis of the muscles that receive innervation directly from the spinal nerve roots (levator scapulae, rhomboids, and serratus anterior muscles) indicate root avulsion injury. An ipsilateral diaphragmatic palsy (Fig 2) indicates a severest form of brachial plexus lesion. Under such circumstances phrenic nerve (C4,5,6) is not a suitable donor in nerve transfer techniques. Presence of severe deafferentation pain indicates root avulsion injury. A positive Tinel's sign in the neck suggests postganglionic injury and possibility of a viable root stump.

Palpation of peripheral pulses is an integral part of clinical examination. An absence of radial or brachial artery pulsation is suggestive of an injury to the subclavian or axillary artery. Vascular injury is present in 10 to 15% of total brachial plexus lesions, more common with infraclavicular injuries.

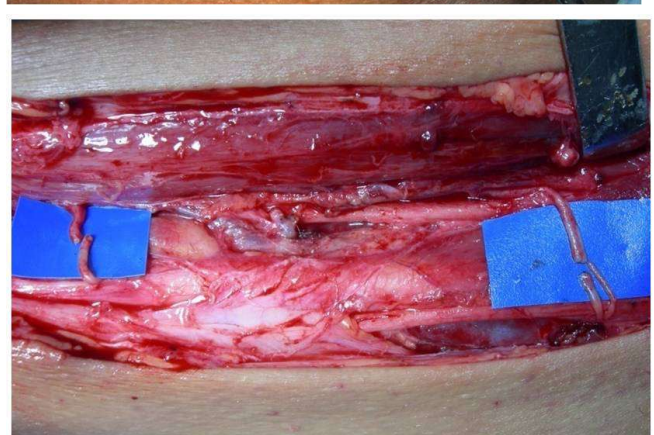
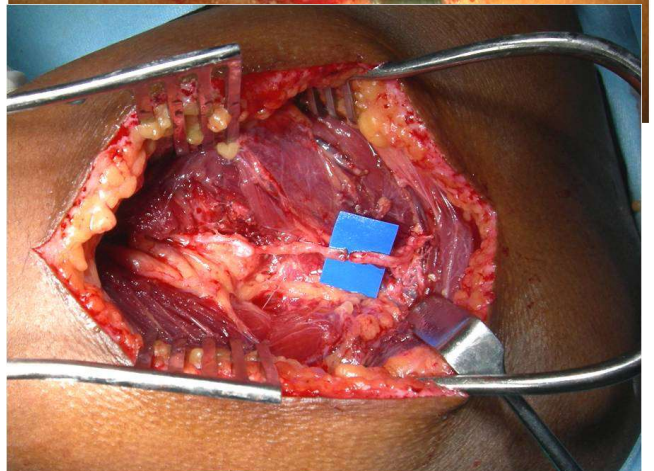
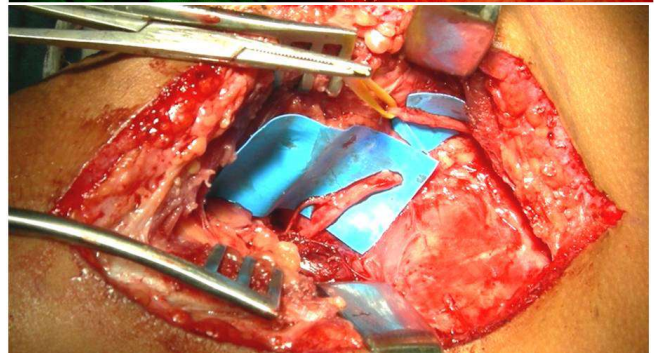
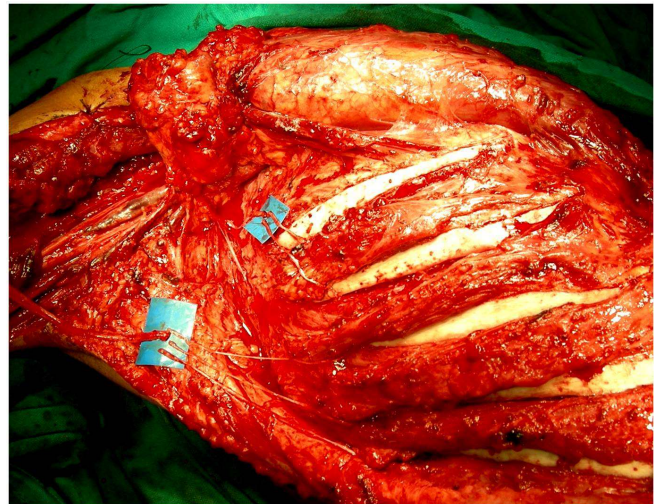
Neuropraxic injuries recover in few weeks time. Other injuries should be observed up to 2 to 3 months for spontaneous recovery. After 4 weeks of injury an electromyography and CT myelography / MR myelography is performed. Patients with clinical (flail and anaesthetic limb, Horner's sign, severe deafferentation pain) and radiological evidence of root avulsions (pseudomeningoceles, Fig 3) are operated early. Other patients should be followed for another 6 to 8 weeks for neurological recovery. If there is no recovery, surgery should not be delayed further as results of surgery deteriorate with passage of time. If partial recovery has occurred, exploration and reconstruction of the nerves that are not recovering is indicated. Management of missile injury of the brachial plexus differs considerably from the traction injuries. The tissues are crushed and burnt from a direct contact with the missile and stretched via temporary cavitation. Wounds are heavily contaminated with virulent organisms. These injuries are better treated as delayed repair if there is little or no recovery.

The neurological examination should determine the specific motor and sensory deficits. The British Medical Research Council (BMRC) grading system is used to measure the motor strength of each muscle. Neurological examination helps in identifying the site and severity of the injury and dictates the treatment algorithm. In partial injury some of the functions in limb are intact. In upper brachial plexus palsy (C5, C6) shoulder and elbow functions are poor however hand functions are preserved. Extended upper plexus palsy (C5,6,7) has an additional weakness in wrist and finger extension. Lower brachial plexus palsy (C8-T1) presents with poor hand functions and normal shoulder and elbow functions.

#### Diagnosis

X- rays : A fracture in the transverse process of cervical spine in a plain radiograph may suggest an injury or avulsion of corresponding root. Similarly fracture of first rib may be associated with lower root injury. A plain chest radiograph showing a raised dome of diaphragm on the injured side suggests an associated phrenic nerve injury. An angiogram of upper extremity is indicated in suspected vascular injury. Presence of fibrillation waves on electromyography performed one month after injury suggests muscle denervation whereas motor unit potentials indicate muscle reinnervation.

Magnetic Resonance Imaging: The use of Magnetic Resonance Imaging (MRI) has gained popularity as an imaging tool in brachial plexus injury. It is non-invasive and provides details of brachial plexus anatomy. MR





myelography (MRM) is a T2 weighted sequence that enhances the contrast between the spinal roots and cerebro spinal fluid. It therefore achieves myelogram like images. MR neurography is a new technique which can localize the site of injury, any disruption in nerve continuity and neuroma formation.

Electrodiagnostic studies (EDS)-These studies help in clinical diagnosis and provide useful information about peripheral nerves and muscles innervated by them. The EDS can diagnose re-innervation before the clinical recovery is evident and can be used as a follow up tool following surgery. EDS essentially record the action potential in the nerves and electrical activities in the muscle. Hence nerve functions both sensory and motor can be assessed by nerve conduction studies (NCS) and muscle electrical activity can be assessed by electromyography (EMG). In closed brachial plexus injuries EDS should be performed 3 to 4 weeks after the injury when Wallerian degeneration has taken place.

#### Surgical management: Nerve related procedures

1. Direct nerve repair- A direct nerve repair without nerve grafts is possible in only sharply transected injuries (stab and iatrogenic injuries) provided the proximal and distal ends can be approximated without the tension. In more common traction injuries nerve ends are retracted apart and a direct coaptation is not feasible.

2. Nerve grafting -Nerve grafting is the predominant technique employed in brachial plexus repair. Nerve grafts are required in traction injuries to bridge the nerve defects once the neuromas are resected. The commonly used donor nerves are the sural nerve, medial cutaneous nerve of the forearm, lateral cutaneous nerve of the forearm and ipsilateral ulnar nerve as a pedicled vascularized nerve graft in lower root avulsions.

The nerve graft should be 20% longer than the length of the nerve defect. Vascularized nerve grafts may be more suitable in a scarred bed and at reconstructing large nerve defects. In global brachial plexus with C8 and T1 root avulsions, pedicled vascularized ulnar nerve has been used for a contralateral C7 root transfer to the median nerve.

3. Nerve transfers- Nerve transfer or nerve bypass procedure involves transfer of a functional but less important nerve to the distal injured nerve usually within a period of 6 to 9 months after the injury. Nerve transfers are performed for repair of severe brachial plexus injury in which the proximal spinal nerve roots have been avulsed from the spinal cord. The use of nerve transfers has been a major advance in the field of



brachial plexus reconstruction with many different donor nerves being used to restore the desired function.

In partial brachial plexus injuries, both extraplexal and intraplexal nerve transfers, result in good functional outcomes.<sup>6</sup> An important aspect in nerve transfer is to reinnervate the target muscle close to its motor end plates.<sup>7</sup> This reduces the denervation period and functional gains are superior when compared to proximal nerve transfer.

In extraplexal neurotization a non brachial plexus component nerve is transferred to an injured nerve. One of the most commonly performed extraplexal nerve transfer is between the spinal accessory nerve (Fig 4) and the suprascapular nerve.<sup>8</sup> This restores useful degree of shoulder abduction and external rotation by reinnervating the supraspinatus and infraspinatus muscles. A simultaneous transfer to the axillary nerve yields much better results in shoulder abduction and is best achieved following a nerve transfer between the triceps branch of radial nerve and the axillary nerve (Fig 5,6,7).<sup>9</sup>

Donor nerves in restoration of elbow flexion include ulnar and or median nerve fascicles, medial pectoral nerve, intercostal nerves (Fig 8), phrenic nerve,

thoracodorsal nerve, and spinal accessory nerve. An intercostal nerve contains no more than 500 motor fibers, hence at least two or three intercostal nerves (T3, T4 and T5) are transferred to the musculocutaneous nerve.<sup>10</sup> In restoration of elbow flexion, the deep central branches of the third, fourth and fifth intercostal nerves are dissected up to the costochondral junction and transferred laterally to the musculocutaneous nerve.

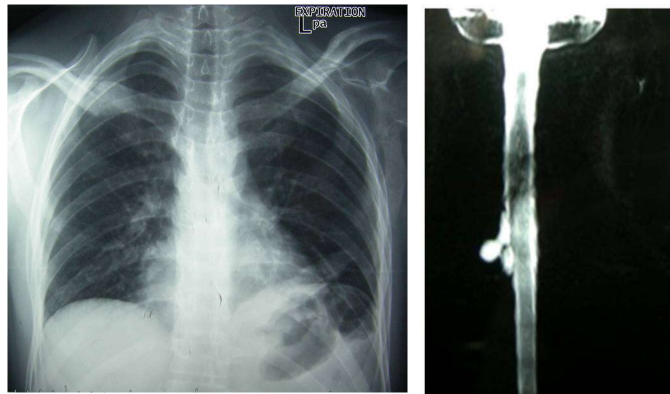
**Fascicular nerve transfers (ulnar and median)-** A longitudinal incision is made along the antero-medial aspect of upper arm. The musculocutaneous nerve is identified after it has traversed the coracobrachialis muscle. In its distal course the musculocutaneous nerve gives off its motor branches to the biceps and brachialis muscles. A longitudinal epineurotomy is made in the ulnar nerve at the level of the biceps motor branch and an isolated fascicle of the ulnar nerve is sutured end to end to the biceps motor branch.<sup>4</sup> In a similar fashion a fascicle of the median nerve is coapted with the motor branch to the brachialis muscle (Fig.9,10,11).

#### Management strategy

**C5 - C6 and upper truncal injury-** An upper truncal injury with intact nerve roots is amenable to nerve graft repair. In C5-C6 root avulsion injury nerve transfer between the distal spinal accessory nerve and the suprascapular nerve through the posterior approach restores useful range of shoulder abduction and external rotation. A simultaneous axillary nerve neurotization in the quadrilateral space further improves the range of shoulder abduction by reinnervating the deltoid muscle.<sup>9</sup>

Elbow flexion is best achieved either by biceps reinnervation, or both biceps and brachialis reinnervation. In C5-C6 injuries intraplexal donor nerves provide better functional results than the extraplexal nerves (spinal accessory, phrenic, or intercostal nerves). The bifascicular nerve transfer between the ulnar and median nerves and the biceps and brachialis branches of the musculocutaneous nerve, has become a standard procedure in restoration of elbow flexion in C5- C6 root avulsion injuries. Sparing of single fascicle from the ulnar or median nerve does not result in any subjective deficit in hand function. Preoperative and postoperative evaluation of pinch strength, grip strength and two point discrimination at the pulp of little and index fingers usually remain unaltered. There is no added advantage in fascicular selection using a nerve stimulator while performing the fascicular nerve transfers.

**C5 - C7 injury-**In addition to the deficits observed in C5-C6 injuries these patients find difficulty in extension of



elbow and wrist. Therefore triceps branch of radial nerve cannot be used for neurotization of axillary nerve. The lack of elbow extension leads to difficulty in putting the hand in space and reaching out on objects which affects prehensile functions. In these injuries reconstruction is similar to C5-C6 injuries, however long head triceps branch can be neurotized by 3rd & 4th intercostal nerves. When C6 root is available, it can be used to reconstruct the radial nerve. However it is important to note that delicate balance is required between elbow flexion and extension. If triceps becomes too powerful, it may adversely affect elbow flexion. Wrist drop is corrected by transfer of pronator quadratus branch of anterior interosseous nerve to the external carpi radialis branch of the radial nerve.

**C5 – T1 injury-** This is a severe injury characterized by flail upper limb. The first priority of reconstruction is elbow flexion followed by shoulder abduction. The hand reanimation is aimed at achieving protective sensation and some finger flexion. In these patients regaining some useful function for their daily activities is aimed at. In case of preganglionic injuries where no graftable root is available, nerve transfers are undertaken to achieve above reconstruction. A single stage reconstruction can be performed in 3 to 5 months post injury. The spinal accessory is used to neurotize suprascapular nerve and 3rd, 4th, & 5th Intercostal nerves are used to neurotize musculocutaneous nerve. To regain protective sensation in hand and achieve finger flexion contralateral C7 (CC7) is used to neurotize median nerve using vascularised ulnar nerve graft.<sup>11</sup> Subsequently, to achieve hand stability wrist arthrodesis and thumb fusion can be performed. Due to long graft and prolonged regeneration time the results of vascularised ulnar graft are unpredictable. Wang et al<sup>12</sup> reported the use of direct coaptation of contralateral C7 root to injured lower trunk by a modified prespinal route. Out of 75 patients 35 also required humerus shortening by 3 to 4.5 cms. In 47 patients they also used CC7 to neurotize



musculocutaneous nerve through bridging antebachial cutaneous nerve arising from lower trunk. They reported successful outcomes in more than 50% of patients with greater than M3+ power in target muscles. Doi et al<sup>13</sup> have described double free functioning muscle transfer using gracilis for achieving hand prehension, elbow flexion in total palsy. They have reported that most of the patients were able to hold a can and could lift heavy objects. In post ganglionic injuries where graft-able roots are available, cable nerve grafts are used to reconstruct shoulder and elbow functions. To achieve shoulder functions we transfer spinal accessory to suprascapular nerve and if C5 root is found graftable then it is neurotized to lateral cord using long cable grafts of sural nerve. When C6 is also found to be graftable it is used to neurotize the posterior cord using cable grafts.

**C8 – T1 injury**-These are uncommon injuries accounting for about 3% of all brachial plexus injuries. Hand functions are poor with preserved shoulder and elbow functions. The reconstruction aims to achieve prehension with protective sensation. Nerve transfers in form brachialis branch of musculocutaneous nerve to anterior interosseous nerve can be done to achieve grasp functions of hand. This however requires an interposition nerve graft. Alternatively brachialis branch can be transferred to posterior fascicular group of median nerve. The posterior fascicular group at brachialis group is composed of anterior interosseous nerve responsible for finger flexion. To restore finger flexion, motor branch to the brachioradialis muscle has been transferred to the anterior interosseous nerve in the management of lower plexus lesions.

**Infraclavicular injury**- These are stretch injuries of brachial plexus and involve the peripheral nerves like axillary, musculocutaneous or radial nerves. Cord injuries may also occur in presence of severe trauma. They account for about 15% of all brachial plexus injuries. They are often associated with shoulder dislocation, or fractures of scapula and humerus and vascular injuries. Hence these injuries are challenging to deal with. Surgical exposure is by infraclavicular incision along the deltopectoral groove and pectoralis major is required to be detached from its insertion. The dissection is often tedious due to extensive scarring, previous surgeries and major vessels of upper limb in closed vicinity entrapped in dense fibrosis. Surgical options in their management include neurolysis, direct nerve repair and nerve grafting.

#### Secondary procedures in brachial plexus injury

Asizable number of patients fail to recover following primary nerve reconstruction. Also there is a group of patients who report more than a year after injury when nerve repair is not feasible. Such cases can be

rehabilitated by secondary procedures such as tendon or muscle transfers, free functioning muscle transfers and skeletal procedures.

#### Summary

Introduction of micro-surgical techniques in devastating brachial plexus injuries has made possible to restore a functioning limb in majority of the patients. An early repair within 3 to 4 months of injury is important for a good outcome.

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## Hair Restoration

Since initial reports on grafting human scalp hair were first made in Japanese literature in 1939, advancements in hair restoration surgery (HRS) have benefitted all patients, including both men in the early stages of hair loss and female patients. Hair restoration has become one of the most common aesthetic procedures performed in the male population.

Rather than continuing the trend of using techniques such as flaps, microsurgery, tissue expansion, and scalp excisions, most surgeons today doing hair restoration have gone to refined, anatomic, naturally occurring miniature grafts in the majority of patients. Modern day hair transplantation evolved over three distinct eras: the “plug” era, the transition period of progressively smaller unit minigrafting and micrografting, and the current period of follicular unit transplantation (FUT). When performed properly, FUT consistently results in a cosmetic appearance indistinguishable from natural scalp hair growth. In addition to the more natural appearance of the transplanted follicles with FUT, the ratio of the donor-to-recipient area has effectively expanded. In the plug era this relationship was at best 1:1, but FUT now favors a ratio of 1:2 or 1:4, meaning 1 cm<sup>2</sup> of donor scalp harvested may yield a sufficient number of FU (also referred to as grafts) to cover a 2 to 4 cm<sup>2</sup> recipient area with adequate cosmetic density. Smaller, more superficial recipient sites can be spaced much more closely, while causing minimal damage to the preexisting hair in the recipient area.

Despite these refinements, the unavoidable progression of hair loss over time and the limitation of donor hair for transplantation remain of paramount importance when determining the surface area and hair density that can reasonably be treated with hair transplant surgery.

### Anatomy of hair

The embryologic origin of hair is both ectodermal and mesodermal. The ectoderm forms the hair and pilosebaceous follicle; the mesoderm forms the dermal papilla.

Hair consists of a shaft and a root. The shaft is the visible portion above the scalp surface; its diameter

varies from 60 to 100  $\mu$ m. The three layers of the shaft – the cuticle, cortex, and medulla – consist of keratinized cells. The root or bulb is the follicle and sits at an oblique angle in the scalp. The human scalp hairs grow naturally in individual bundles, called follicular units (FUs), comprised of clusters of one to four follicles surrounded by concentric layers of collagen fibers.

### Anatomy of normal hairline

A critical anatomic landmark in the mature male hairline is the frontal-temporal recession. This landmark is formed by the emergence of two convex lines making up the frontal and the temporal hairlines. Design of the frontal-temporal recession is critical to a natural result. Young males usually do not have this recession, and this is one characteristic that distinguishes the child from the adult pattern. As baldness progresses, the frontal-temporal recession increases, forming an acute angle. Both women and children tend to have a continuous line between the frontal and temporal areas without this recession. Another important characteristic of a natural hairline is the transition from fine hair to more dense hair with a degree of irregularity along the margin. Natural hairlines are not straight and regular. Many of the unsatisfactory results in hair restoration demonstrate a fundamental lack of knowledge of these critical points. Other important factors are that the hair follicle sits about 3–3.5 mm below the surface of the scalp and that scalp thickness varies between 5.5 and 6.5 mm. These factors are important in considering the placement of the grafts in the scalp, the thickest layer of skin on the human body.

### Hair growth cycle

There are essentially three cycles – anagen, catagen, and telogen. During the growth phase, referred to as anagen, the follicular cells are actively reproducing, and matrix keratinocytes are producing cells that differentiate into the different hair components. It is estimated that approximately 90% of the hair on the scalp is in the anagen phase, which lasts approximately 2–5 years. During the regression phase, called catagen, there is a degeneration of the keratinocytes, and special mesenchymal cells,

referred to as dermal hair papillae, cluster and separate. This phase typically lasts 2–3 weeks. The final resting phase, called telogen, lasts approximately 3 months. During the 3–4-month phase of telogen, the follicle is inactive and hair growth ceases.

Approximately 10% of hairs are in telogen phase at any one time. In the telogen phase, the dermal papilla releases from its epidermal attachment, and eventually there is a reforming of a growing bulb. The old hair is shed, and as the cycle goes back to anagen, a new hair will come up and grow in this area.

### Types of baldness

The most common type of hair loss in both men and women is referred to as androgenic alopecia. The mechanism of androgenic alopecia is inherent in each individual hair follicle as it responds to external stimuli, essentially androgens. The progressive loss of hair is predetermined by genetic characteristics associated with these responsive scalp follicles. Androgenic alopecia is under the control of a single dominant sex-linked autosomal gene. However, this may be influenced by other modifying factors, and there is probably a polygenic component to the expression of male-pattern hair loss. In most men with hair loss, the hair follicles in the frontal and crown regions of the scalp appear most likely to be affected by androgenic alopecia.

Hair loss in women is frequently of a diffuse nature, and thus, most women may not be ideal candidates for hair restoration. The pattern of hair loss, because of its diffuseness, often results in a lack of appropriate donor hair. However, there is a subgroup of women who demonstrate hair loss similar to the male pattern. The hair loss in these women frequently begins at the vertex and progresses anteriorly as they approach their 30s and 40s. In many women, however, the cause of hair loss is secondary to numerous factors, such as surgery, metabolic disorders, chemotherapy, stress, and autoimmune disease. Traumatic alopecia is primarily secondary to ischemia of the hair bulbs, although it can be secondary to direct tissue loss, as in post-burn alopecia.<sup>5</sup> Numerous factors can lead to this ischemia. One of the most common causes of traumatic hair loss is aesthetic surgery of the face and scalp area. Temporal hair loss is probably the most common of this group.

### Classification

Numerous classifications of hair loss have been described on a morphologic basis, which compares the hair-bearing with the non-hair-bearing areas. The first attempts to classify patterns of baldness were described in 1950 by Beek in male white patients and in 1951 by Hamilton, who analyzed patterns of hair loss

in both white and Chinese patients. Later, others, including Norwood, suggested modifications of Hamilton's classification. Most of these classifications divide the patterns of baldness into six or seven main groups with subgroups. These classifications may be difficult to apply because so many variations can be seen from patient to patient. Another classification system developed by Bouhanna and Dardour distinguishes three stages, with variances in stage 1 and stage 2, thus defining five basic patterns. Ludwig devised a classification system for types of androgenic alopecia in women. All classification techniques have some limitations but can be useful tools in planning hair restoration.

### Evaluation of patient and goals of hair restoration

Compared with other areas of aesthetic surgery, hair restoration is unique in that hair loss is not only progressive but also unpredictable. When a patient presents a history of brothers, uncles, and a maternal grandfather with significant baldness, one can predict with some certainty that this patient is also likely to have extensive hair loss. Thus, designing the hair restoration pattern for this patient should consider this family history.

Another factor is the great variation in available donor hair. One can see patients with an abundance of donor hair ranging from 240 to 400 hairs per square centimeter who can undergo multiple future procedures. There are also patients with far less donor hair, and a conservative approach must be entertained.

The individual who has a Norwood II or III pattern and has stabilized is more likely to obtain an excellent result, without worrying about continually chasing further hair loss. A thorough examination of the patient requires an assessment not only of the pattern of hair loss but also of characteristics such as color, texture, density, curling, and straightness. Curly hair tends to appear denser because it covers up the underlying scalp. However, straight, dark hair, unlike curly hair, may not appear to have as much density because of the scalp's visibility between the straight dark hairs, especially if the skin is light.

A thorough evaluation of the donor area is the critical initial step. The following elements should be considered: density of FUs per surface unit, number of hairs per FU, anagen–telogen ratio, diversity of hair caliber, color contrast between the hair and the scalp, hair texture (e.g., wave, curl, and frizz), and scalp laxity. While experienced hair restoration surgeons may be able to evaluate these characteristics with the naked eye, many practitioners prefer diagnostic tools to

quantitatively assess the donor area

Finally, the patient who has unrealistic expectations, especially if young and demanding a procedure that the physician considers inappropriate, should be rejected for surgery. There are also patients with medical problems that can interfere with grafting, such as hypertension, which can cause bleeding, but this usually can be corrected with the appropriate antihypertensives.

The goal is to design a hairline in harmony with the mature face and to re-establish a balance between the scalp and the other facial features. In most patients, the anterior level of the hairline in the midline should be at least 8–10 cm above the glabella. In addition, the anterior hairline appears more natural if it runs parallel to the ground when viewed from a lateral vantage point. In young patients the best approach is to graft the frontal and superior regions first and wait until their hair pattern is more mature before working on the occipital area.

#### Role of medications

Both minoxidil in a local application and finasteride administered orally have been used in the medical management of hair loss. It is believed that minoxidil works primarily by increasing blood flow, which promotes hair regrowth or hair stabilization in those follicles that are being affected genetically by androgenic alopecia. Finasteride, which is an oral medication, is a selective inhibitor of 5 $\alpha$ -reductase type II, thereby having an impact on DHT and the androgen receptors of the hair follicles. Studies document that 1 mg/day finasteride not only reduces hair loss but, in a limited percentage of patients, can cause some growth of hair. This is usually more effective in the younger population, and once true baldness has occurred, it is unlikely that finasteride will have any significant effect.

#### Pre operative anesthesia

Preoperative sedation is often in the form of an oral benzodiazepine (diazepam 10 to 20 mg or lorazepam 2 mg) along with an analgesic (hydrocodone/acetaminophen 5/325 mg). Local anesthesia of the donor site is achieved by creating a field block inferior to the donor region using 1% lidocaine HCl with epinephrine (1:100,000) followed by longer acting 0.25% to 0.5% bupivacaine HCl with epinephrine (1:100,000). This local ring block effectively anesthetizes the greater and lesser occipital nerves as well as the postauricular nerve.

A field block anterior to the anticipated recipient area is then performed and reinforced in the same manner. Regional nerve blocks of the supraorbital and supratrochlear nerves are an alternative method of

anesthesia for the recipient site.

#### Harvesting techniques

1. **Strip excision:** It is the most common method for donor harvesting, used in roughly 88.5% of HRS cases. A donor strip of 0.8 to 1.2 cm width is excised from the densest portion of the safe donor area. Using magnification to help follow the angle and direction of hair shaft exit from the skin, minimal follicle transection can be achieved. If donor wound closure requires an unanticipated degree of tension, undermining skin edges may sometimes be coupled with a two-layered closure using interrupted absorbable sutures (3-0 or 4-0 vicryl or monocryl). A “trichophytic” closure may be used to provide further camouflage of the donor scar.

2. **Follicular Unit extraction:** FUE is an alternative method of hair follicle harvesting that involves removal of individual FUs directly from the donor area one at a time. Originally involving the use of a sharp 1-mm “cookie cutter”-like punch, hair follicles trimmed to 2 mm in length were extracted manually in a random distribution so as to avoid overharvesting any particular area, which may result in a “moth-eaten” appearance. Powered instruments for FUE have replaced manual punches by demonstrating increased extraction speed and efficiency. Only every third or fourth FU can be removed from the SDA, thus reducing the total number of “most likely permanent” follicles available for transplantation. The overall density in the donor area is reduced; as opposed to strip harvest in which both the number of hairs and the surface area is reduced, FUE removes hair and the donor site heals by secondary intention. This effectively leaves the surface area relatively unchanged, but reduces the number of hairs within the SDA.

#### Graft preparation and storage

The stages of FU preparation during a classic FUT procedure are:

- 1) the initial donor strip harvest;
- 2) the “slivering” of the donor strip; and 3) the subsequent dissection of individual FU from the “slivers.” Each phase shares the common objective of increasing graft survival by minimizing follicle

transection. The FU created from the naturally occurring hair groupings that exist in the donor area are markedly smaller than the original 4-mm punch grafts or multi-follicular unit (MFU) grafts

referenced in prior editions of this textbook. Ultimately, the ideal “pear-shaped” graft possesses little or no surplus epidermis and retains an appropriate amount of protective dermis and subcutaneous adipose tissue around the follicle, the



intact sebaceous glands, and the dermal papilla in order to reduce their sensitivity to traumatic handling, temperature changes, and graft desiccation (the main cause of poor graft survival).

Generally speaking, survival of transplanted grafts decreases about 1% per hour out of body with some studies indicating an 88% survival at 8 hours in chilled normal saline. To help counteract the effects of this extended time between harvest and implantation, three broad categories of commercially available holding solutions are considered as alternatives: 1) intravenous fluids (e.g., Plasmalyte A and Lactated Ringer's); 2) culture media (DMEM, RPMI, and M199); and 3) hypothermic tissue-holding solutions (Viaspan, Celsior, Custodiol, and HypoThermosol). Platelet-rich plasma (PRP) has been explored as a possible graft storage solution.

### Recipient site

A recipient site can vary in size, shape, depth, width, angle, and direction. Angle and direction are distinct entities. Angle refers to the degree of hair elevation as it exits the scalp. Direction refers to which way the hair points when leaving the scalp. Hair direction emanates from a whorl in the vertex, it is mainly posteriorly or anteriorly oriented within the caudal scalp, and it is inferiorly and often inferoposteriorly directed in the temporal and parietal regions. Although it has been demonstrated that more acute angles appear to increase perceived scalp coverage, it cannot be overemphasized that both the direction and the angle of the recipient site incisions should mimic the preexisting hair within the region of the scalp that is being treated. Traditionally, surgeons have oriented recipient sites parallel to the direction of hair growth (sagittally when within the caudal scalp). To create the illusion of a slightly lower hairline without expending too many FUs, some surgeons construct a "widow's peak." Throughout the hairline, the transition zone (the anterior 0.5 to 1 cm region) should contain both microirregularities (intermittent density clusters more noticeable under close examination than from a distance) and macroirregularities (protrusions along the path of the hairline that cause it to appear less linear when viewed from a distance). Generally, macroirregularities include one central mound and two lateral mounds. As a guideline, three- or four-haired FU should fit snugly into recipient sites made with an 18G needle while 20G needle sites should easily accommodate one-haired FUs.

### Post operative period

Once the transplanted FUs have all been placed, many physicians place a postoperative bandage for one night

over the patients' scalp. Soaking the scalp after the bandage has been removed facilitates crust dissolution and helps prevent further crust formation. Showering the recipient area is also reserved until after 5 to 7 days postoperatively. In addition to analgesic use (acetaminophen or narcotics), patients should ice a few times a day for 10- to 15-minute intervals along the nape of the neck (only inferior to the wound) to help minimize localized edema, which may cause increased tension in the donor area. Tissue edema in the forehead and temporal areas usually becomes most evident 3 to 5 days postoperatively. Although patients may vary considerably, substantial cosmetic improvement is present after 9 to 12 months, and the general timeline for hair growth after surgery is as follows: newly transplanted fine hairs begin to appear around the third or fourth postoperative month and the number and caliber of transplanted hairs continue to increase until full growth can be appreciated approximately 18 to 24 months after a session.

### Perioperative adjunctive therapy

Many surgeons encourage young patients to complete a trial of oral finasteride therapy prior to proceeding with surgery, especially in those who are destined to develop a severe pattern of MPB in the future and those in whom a thinning crown is of utmost concern. The degree of hair growth is most noticeable in the vertex and less dramatic in more anterior regions of the scalp. Many surgeons encourage topical minoxidil application (3.5%) for its vasodilatory effects that may enhance wound healing. Continued minoxidil use is encouraged for 5 to 12 weeks postoperatively. Autologous PRP administration is also an emerging adjunctive therapy requiring further investigation.

### Future of hair transplant surgery

The advent of robotics in hair transplantation currently allows for automated harvesting of hair follicles using the FUE method. Ultimately, the day will come when robots will automate the entire hair restoration procedure, performing both retrieval and implantation.

Cell therapy in HRS remains on the horizon. Stem cell rich regions of the hair follicle are believed to be the mesenchymal cells located at both the bulb region (dermal papilla) and the bulge region. The concept of isolating hair follicle stem cells and propagating them in vitro to generate new hair follicles was proposed over two decades ago. It was believed that autologous implantation of these replicated hair follicles into the balding scalp would generate new hair follicles.



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## Burns are injuries of the skin involving the two layers

Burns are injuries of the skin involving the two layers: the thin, outer epidermis and the thicker, deeper dermis. 86% of burns are caused by thermal injury, while about 4% are electrical and 3% are chemical. This activity describes the pathophysiology, epidemiology, clinical presentation, evaluation, and management of burns and the importance of the interprofessional team in educating patients to prevent such injuries and effective management of such patients.

A variety of factors guides the evaluation and management of burns. First is the type of burn such as thermal, chemical, electrical or radiation. Second is the extent of the burn usually expressed as the percentage of total body surface area (%TBSA) involved. Next is the depth of the burn described as superficial (first degree), partial (second degree) or full thickness (third degree). Finally, other factors include specific patient characteristics like the age of the patient (< 10 or > 50 years old); other medical or health problems; if there are specialized locations of the burn (face, eyes, ears, nose, hands, feet and perineum); and if there are any associated injuries, particularly smoke inhalation and other traumatic injuries.

### Extent of the Burn

Several methods are available to estimate the percentage of total body surface area burned.

- **Rule of Nines** - The head represents 9%, each arm is 9%, the anterior chest and abdomen are 18%, the posterior chest and back are 18%, each leg is 18%, and the perineum is 1%. For children, the head is 18%, and the legs are 13.5% each.
- **Lund and Browder Chart** – This is a more accurate method, especially in children, where each arm is 10%, anterior trunk and posterior trunk are each 13% and the percentage calculated for the head and legs varies based on the patient's age.
- **Palmar Surface** - For small burns, the patient's palm surface (excluding the fingers) represents approximately 0.5% of their body surface area, and the hand surface (including the palm and fingers) represents about 1% of their body surface area.

### Depth of the Burn

Burn depth is classified into one of three types based on how deeply into the epidermis or dermis the injury

might extend.

- **Superficial burns (First Degree)** involve only the epidermis and are warm, painful, red, soft and blanch when touched. Usually, there is no blistering. A typical example is a sunburn.
- **Partial thickness burns (Second Degree)** extend through the epidermis and into the dermis. The depth into the dermis can vary (superficial or deep dermis). These burns are typically very painful, red, blistered, moist, soft and blanch when touched. Examples include burns from hot surfaces, hot liquids or flame.
- **Full-thickness burns (Third Degree)** extend through both the epidermis and dermis and into the subcutaneous fat or deeper. These burns have little or no pain, can be white, brown, or charred and feel firm and leathery to palpation with no blanching. These occur from a flame, hot liquids, or superheated gasses.

When calculating the extent of burn, only partial thickness and full thickness burns are considered, and superficial burns are excluded.

### Treatment / Management

The American Burn Association recommends burn centre referrals for patients with:

- partial thickness burns greater than 10% total body surface area
- full thickness burns
- burns of the face, hands, feet, genitalia, or major joints
- chemical burns, electrical, or lightning strike injuries
- significant inhalation injuries
- burns in patients with multiple medical disorders
- burns in patients with associated traumatic injuries

Patients being transferred to burn centres do not need extensive debridement or topical antibiotics before transfer. Whether transferring or referring to a burn centre, you should contact them before beginning extensive local burn care treatments.

Minor burns which you plan to treat can be approached using the “C” of burn care:

- **Cooling** - Small areas of burn can be cooled with tap water or saline solution to prevent progression

of burning and to reduce pain.

- **Cleaning** – Mild soap and water or mild antibacterial wash. Debate continues over the best treatment for blisters. However, large blisters are debrided while small blisters and blisters involving the palms or soles are left intact.
- **Covering** – Topical antibiotic ointments or cream with absorbent dressing or specialized burn dressing materials are commonly used.
- **Comfort** – Over-the-counter pain medications or prescription pain medications when needed. Splints can also provide support and comfort for certain burned areas.

For burns classified as severe (> 20% TBSA), fluid resuscitation should be initiated to maintain urine output > 0.5 mL/kg/hour. One commonly used fluid resuscitation formula is the Parkland formula. The total amount of fluid to be given during the initial 24 hours = 4 ml of LR × patient's weight (kg) × % TBSA. Half of the calculated amount is administered during the first eight hours beginning when the patient was initially burned.

In patients with moderate to severe flame burns and with suspicion for inhalation injury, carboxy-hemoglobin levels should be checked, and patients should be placed on high flow oxygen until carbon monoxide poisoning is ruled out. If carbon monoxide poisoning is confirmed, continue treatment with high-flow oxygen and consider hyperbaric oxygen in select cases (see Hyperbaric, Carbon Monoxide Toxicity chapter). Cyanide poisoning can also occur from smoke inhalation and can be treated with hydroxocobalamin (see Inhalation Injury chapter).

Burns commonly occur by direct or indirect contact with heat, electric current, radiation, or chemical agents. Burns can lead to cell death, which can require hospitalization and can be fatal.

### Considerations

There are three levels of burns:

- First-degree burns affect only the outer layer of the skin. They cause pain, redness, and swelling.
- Second-degree burns affect both the outer and underlying layer of skin. They cause pain, redness, swelling, and blistering. They are also called partial thickness burns.
- Third-degree burns affect the deep layers of skin. They are also called full thickness burns. They cause white or blackened, burned skin. The skin may be numb.

Burns fall into two groups.

Minor burns are:

- First degree burns anywhere on the body
- Second degree burns less than 2 to 3 inches (5 to 7.5 centimeters) wide

Major burns include:

- Third-degree burns
- Second-degree burns more than 2 to 3 inches (5 to 7.5 centimeters) wide
- Second-degree burns on the hands, feet, face, groin, buttocks, or over a major joint

You can have more than one type of burn at a time.

Major burns need urgent medical care. This can help prevent scarring, disability, and deformity.

Burns on the face, hands, feet, and genitals can be particularly serious.

Children under age 4 and adults over age 60 have a higher chance of complications and death from severe burns because their skin tends to be thinner than in other age groups.

### Causes

Causes of burns from most to least common are:

- Fire/flame
- Scalding from steam or hot liquids
- Touching hot objects
- Electrical burns
- Chemical burns

Burns can be the result of any of the following:

- House and industrial fires
- Car accidents
- Playing with matches
- Faulty space heaters, furnaces, or industrial equipment
- Unsafe use of firecrackers and other fireworks
- Kitchen accidents, such as a child grabbing a hot iron or touching the stove or oven

You can also burn your airways if you breathe in smoke, steam, superheated air, or chemical fumes in poorly ventilated areas.

### Symptoms

Burn symptoms can include:

#### Blisters

- that are either intact (unbroken) or have ruptured and are leaking fluid.
- Pain -- How much pain you have is unrelated to the level of burn. The most serious burns can be painless.
- Peeling skin.

#### Shock



- Watch for pale and clammy skin, weakness, blue lips and fingernails, and a decrease in alertness, Swelling, Red, white, or charred skin.

You may have an airway burn if you have:

- Burns on the head, face, neck, eyebrows, or nose hairs, Burned lips and mouth, Coughing  
Difficulty breathing
- Dark, black-stained mucus, Voice changes  
Wheezing

### First Aid

Before giving first aid, it is important to determine what type of burn the person has. If you are not sure, treat it as a major burn. Serious burns need medical care right away. Call your local emergency number or 911.

### MINOR BURNS

If the skin is unbroken:

- Run cool water over the area of the burn or soak it in a cool water bath (not ice water). Keep the area under water for at least 5 to 30 minutes. A clean, cold, wet towel will help reduce pain.
- Calm and reassure the person.
- After flushing or soaking the burn, cover it with a dry, sterile bandage or clean dressing.
- Protect the burn from pressure and friction.
- Over-the-counter ibuprofen or acetaminophen can help relieve pain and swelling. DO NOT give aspirin to children under 12.
- Once the skin has cooled, moisturizing lotion containing aloe and an antibiotic also can help.

Minor burns will often heal without further treatment. Make sure the person is up to date on their tetanus immunization.

### MAJOR BURNS

If someone is on fire, tell the person to stop, drop, and roll. Then, follow these steps:

- Wrap the person in thick material; such as a wool or cotton coat, rug, or blanket. This helps put out the flames.
- Pour water on the person.
- Call 911 or your local emergency number.
- Make sure that the person is no longer touching any burning or smoking materials.
- DO NOT remove burned clothing that is stuck to the skin.
- Make sure the person is breathing. If necessary, begin rescue breathing and CPR.
- Cover the burn area with a dry sterile bandage (if available) or clean cloth. A sheet will do if the burned area is large. DO NOT apply any ointments.

Avoid breaking burn blisters.

- If fingers or toes have been burned, separate them with dry, sterile, non-stick bandages.
- Raise the body part that is burned above the level of the heart.
- Protect the burn area from pressure and friction.
- If an electrical injury may have caused the burn, DO NOT touch the victim directly. Use a non-metallic object to separate the person away from exposed wires before starting first aid.

You will also need to prevent shock. If the person does not have a head, neck, back, or leg injury, follow these steps:

- Lay the person flat
- Raise the feet about 12 inches (30 centimeters)
- Cover the person with a coat or blanket

Continue to monitor the person's pulse, rate of breathing, and blood pressure until medical help arrives.

### DO NOT

Things that should not be done for burns include:

- DO NOT apply oil, butter, ice, medicines, cream, oil spray, or any household remedy to a severe burn.
- DO NOT breathe, blow, or cough on the burn.
- DO NOT disturb blistered or dead skin.
- DO NOT remove clothing that is stuck to the skin.
- DO NOT give the person anything by mouth if there is a severe burn.
- DO NOT place a severe burn in cold water. This can cause shock.
- DO NOT place a pillow under the person's head if there is an airways burn. This can close the airways.

### Prevention

To help prevent burns:

- Install smoke alarms in your home. Check and change batteries regularly.
- Teach children about fire safety and the danger of matches and fireworks.
- Keep children from climbing on top of a stove or grabbing hot items such as irons and oven doors.
- Turn pot handles toward the back of the stove so that children can't grab them and they cannot accidentally be knocked over.
- Place fire extinguishers in key locations at home, work, and school.
- Remove electrical cords from floors and keep them out of reach.
- Know about and practice fire escape routes at home, work, and school.
- Set the water heater temperature at 120°F (48.8°C) or less





## Awareness of Prevention and Management of Pediatric Burn

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Thermal injury is one of the leading causes of morbidity and mortality in children worldwide, more so in low and middle income group countries (LMICs). The scald is the cause of burn injuries in more than 60% of the children. Prevention and management of burn in children is a herculean task in our country.

Burn is one of the top 3 causes of deaths amongst children in India. Still this has not caught the attention of the government and medical institutions. Pediatric burn accounts for 17-25% of all burn hospital admissions in India. Approximately 90% of these burns are caused by hot liquids at home. All the epidemiological studies worldwide have more or less similar findings.

### Causes of Burns in Children:

Most often the pediatric burns are household thermal injuries caused by hot liquids. The hot liquids are in the form of hot water in kitchen or in bathroom, tea, coffee, daal, soup, hot vegetables, and oil. Flame and contact burns make the second group of aetiological factors. LPG gas in kitchen is responsible for accidents involving children and adults together. Children are usually involved because of unsafe use of LPG stoves on the ground and within the reach of children. There is rising incidence of electrical burns specially in older children and adolescents because of contact with live wire or live power plugs. Increasing availability of electrical and electronic gadgets in our day-to-day life is causing more accidents. Few children are hospitalised for chemical injuries with acid and other chemicals at home or following acid attacks.

### Preventive measures:

Burn injuries are largely preventable specially in children. They can be prevented only by aggressive awareness programmes. Relevant programmes in schools and social media can play important roles in this field. One needs to design and display the preventive methods in the local language in a way that it catches the attention of common-men. Government needs to pass strict legislations on "Safe cooking devices and factory acts" which should be implemented. **(Table 1)**

There have been many individual efforts by many

burns and plastic surgeons, programmes by National Academy of Burns-India, members of the Indian Medical Association and few NGOs in this direction. But this is a drop in the ocean of 140 crore population. A lot more needs to be done to disseminate the prevention and first aid across the country.

Establishing Acid Attack Survivors Foundation in many countries including India is a recent success story. The Supreme Court in a landmark Judgement held that under section 357B of Criminal Penal Code, the acid victims are entitled for free treatment and compensation. The Union Government of India has implemented the judgement benefitting a large number of such victims. Also there has been a judgement on availability of acid in the market, however, this ruling is not effectively implemented as of now.

### Table 1: Some of the Measures for Prevention of Pediatric Burns

- Cooking should be done with utmost care over raised platform.
- Hot cooking utensils and hot objects should be out of reach of children.
- Children should be kept away from cooking stove/ LPG gas stove.
- Overcrowding should be avoided.
- Temperature of water should be checked before use for bathing children.
- Cooking or any kind of fire should not be allowed inside the tents.
- Electric live wires and plugs should be kept out of reach of children.
- Chemicals especially acids should not be available at home. If it is essential it should be well labelled and stored safely away from the reach of children.
- Chargers should be kept safely.
- Used batteries should be disposed off properly.
- Firecrackers should be allowed only under the supervision of an attentive adult with available first aid measures.
- Metallic thread for kite flying should be avoided as it can cause electrical or flash burn.

*Continued on page 35...*



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## Skin Grafts and Flaps in Plastic Surgery

### Introduction

A “flap” may be defined as a tissue unit which when transferred from its native location to a defect, does not rely on vascular ingrowth from the bed of the defect for its survival. In other words the vascular network responsible for nourishing the tissue unit remains unchanged even after transfer of the flap. This is quite unlike a “graft” which relies on nourishment from the bed of the defect to ensure survival. Interestingly, artificial tissue matrices like Integra Bilyer Matrix Wound Dressing (Integra Lifesciences Corp Plainsboro, NJ) manufactured in a laboratory do not have native vascular networks either. Hence these matrices essentially behave as “grafts” when applied over a given defect. Tissue engineering has not reached a level where composite tissue matrices with a native vascular network can be manufactured.

### Criteria for choosing flaps

Flaps are required to reconstruct defects. It is useful to characterise any defect in terms of the anatomical and functional deficits that need reconstruction. A flap should ideally reconstitute both structure and function. However, it is not always possible to restore a defect back to its original state. Nevertheless the essential functions should be restored. For example, following total glossectomy, the speech and swallowing functions need to be restored but the taste sensations cannot be reconstructed with the available technology. In general, an anatomical defect may involve the skin (or mucosa), muscle and/or bone in variable degrees. However, a single tissue unit containing all the missing anatomical units may not be required to reconstruct every defect. As long as acceptable aesthetic and essential functional requirements are met any “flap” may be used for reconstruction. Donor site morbidity is also an important consideration when one has the liberty of choosing one of two “flaps” with same tissue composition. If a flap is chosen such that a margin of the flap is situated adjacent to the defect, it is termed a “local” flap. All other flaps are termed “distant” flaps.



### Design of flaps

The tissue unit destined to be transferred can be circumferentially cut from the body and completely separated from its bed except at the point of entry of its vascular pedicle and is termed an “island” flap. However, if the flap is not completely cut from its surrounding tissues, it is termed a peninsular

Daniel RK. Letter: Toward an anatomical and hemodynamic classification of skin flaps. *Plast Reconstr Surg.* 1975; 56:330-2. flap (from Latin words *paene* meaning 'almost' and *insula* meaning 'island'). The first flaps ever to be described were possibly “peninsular flaps” attached to the cheek and used to reconstruct the mutilated noses of subjects in the Indian subcontinent. When a flap pedicle is divided and the flap transported to a distant defect, it is termed a free flap or a free microvascular tissue transfer surgery. The transformation of the pedicled to a free flap requires re-establishment of circulation by microvascular anastomoses of the artery and vein of the pedicle to recipient vessels near the defect.

### Take of a flap and graft

Once a flap is inset into a defect, there is a gradual link-up of the tissue elements in recipient bed and the tissue elements of the flap. This is akin to “take” of a skin graft although the process is not identical. Once a flap survives the transfer and settles, the vascular pedicle may be divided after a *sufficient* period of time has elapsed without compromising on flap viability. The reason behind this phenomenon is vascular ingrowth from the

recipient bed into the flap. The knowledge of these phenomena has been used by surgeons to devise ingenious techniques to transfer tissue.

### The Restitutive Bookcase and the Reconstructive Ladder

Mathes described the reconstructive ladder as a tool to understand reconstructive needs of a wound. He envisioned a ladder which had the least complicated solution to heal a wound at its bottom rung and a complicated solution to heal a wound at the top rung. The plastic surgeon would have to climb the ladder in order to choose the best option for a given patient. This author has described a restitutive library as a better tool to comprehend the reconstructive needs of a wound. The author sees the restitutive bookcase as a repository of tools that is accessible to a plastic surgeon; however each tool (or book) is chosen with

the aim not only to heal the wound but what is appropriate for the patient with the best possible outcome in mind.

### Conclusion

The predictability of flap survival has increased significantly with a better understanding of its associated vascular territory. Skin grafts and flaps have their indications and should be chosen wisely to reconstitute a patient completely.

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## Awareness of Prevention and Management of Pediatric Burn

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### First Aid:

The source of heat should be removed or extinguished from the contact with the child. Then plain water should be poured on the burnt area. Plain running water at room temperature is recommended for 10-15 minutes or till the pain subsides. In children ice or ice-cold water should be avoided as it may cause hypothermia.

In case of flame burn, an attempt should be made to extinguish the fire. The burning clothes should be removed and then water should be poured. In electrical injury the electric current should be stopped and then the first aid should be given. If chemical is the cause of burn, the area should be cleaned with copious running water. No attempt should be made to use the neutralising agent as it will cause exothermic reaction and more harm.

### Initial Onsite Management:

Children should be rapidly assessed and quick decision should be taken about maintaining airway (A), breathing (B) and Circulation (C). They should be assessed and monitored for any neurological or motor disability (D) and detailed examination should be performed accurately by exposing (E) the victim.

If either A,B,C are compromised immediate relevant emergency management should be started. Child with burn should be shifted to the hospital after starting the essential management on site. They should be transported under the supervision of a trained personnel.

### Initial Assessment in the Hospital (Primary Survey):

On arrival to the hospital after quick examination of the child decision needs to be taken for hospitalisation or to be treated at home. The American Burn Association has recommended following criteria for

hospitalisation of the children with burn:

- Children with >10% Total Body Surface Area Burn (TBSAB)
- Full thickness burn >2% (TBSAB)
- Burn in the special areas eg. Face, genitals, hands, perineum etc
- Circumferential extremity burn
- Special modes of burn injuries eg electrical, chemical, radiation
- Children with inhalational injury
- Children with co-morbidities
- Suspected child abuse
- Wherever there is a doubt of inadequate care at home.

Children who are to be treated at home should be sent after appropriate wound management and prescription of analgesics, antibiotics if indicated and advice for return to the hospital at regular intervals as required. Children requiring hospitalisation are managed as per the detail protocol of the burn centre and the specialist.

### Detail History and Assessment (Secondary Survey):

A detail history should be taken regarding the cause of the burn, fluid administered (oral and intravenous) and care given since the time of burn. Detail assessment is done regarding body surface area burn, depth of burn, associated injury, inhalational injury etc

### Extent of Burn:

'Rule of Nine' and 'Palmar surface estimation' are not reliable in children. Lund and Browder chart is more accurate for calculating the burn surface area in children. (Figure 1) This chart takes into account the variation in the body surface area in different age groups.



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Microsurgery is a general term for surgery requiring an operating microscope. It has been around for more than 5 decades. They have revolutionized surgical treatment for difficult problems in burn reconstruction, cancer reconstruction and trauma reconstruction. and have come a long way in improving the quality of life. Microsurgery is not limited to plastic surgery alone, Microsurgery is frequently employed in neurosurgery, ophthalmology, ENT surgeries and a lot of other fields.

Microvascular surgeries reach has increased both in reach and complexity over the years as experience in these surgeries are ever increasing. There has been increased focus and training in microsurgery.

Microsurgery as the name suggests is repair of small structures such as nerves and blood vessels. Microsurgery is a surgery in which operating microscope is used which allows one to do repairs under great magnification.

The common man is helped by microsurgical reconstruction. If we see the areas to where microsurgery has reached out and helped. Then we would realize the extent to which microsurgery is helping us get back to normal, with reduced scarring, reduction of hospital stay and quicker recovery,

Initially microsurgery was not the first choice when techniques were being developed and experience was limited. But with increased training and long years of experience. Now it is often the first choice of reconstruction.

We can look at the possibilities of microsurgery

#### **MICROSURGERY IN TRAUMA**

Injuries caused by Road traffic accidents , industrial accidents, Gun shot injuries have become so common with ever increasing industrialization and increased use of motor vehicles.

*Plastic surgery has become essential for proper management of such traumatic injuries. And without microsurgery the best possible functional and aesthetic outcome is difficult or impossible to achieve.*

These injuries can result in complex wounds which can be complicated by

1. Amputations
2. Loss of circulation

## Microsurgery Surgeries

3. Loss of sensation
4. Extensive Loss of soft tissue
5. Nerve injuries
6. Loss of functional muscles

**Replantation:** When amputations are encountered especially in upper and lower extremity. It is often possible to Replant the amputated part back to the person thereby restoring both function, body image and cosmesis for the patient. Here again one is required to bring the amputated part properly preserved for possible replantation.

Replantation is now possible for many parts

**In upper limb** fingers, hands, forearm, elbow and arm level amputations in upper limb,

**In lower limbs** – Toes, forefoot , ankle, leg , knee and thigh level amputations can be replanted

**Genitals** – Penile amputations , testicular amputations can be replanted.

**Face** - Scalp avulsions, Nose, Ears, lips and partial face amputations can be replanted.

Another major problem is injuries where the limb is still attached but there is loss of circulation. Resulting in ischemia distal to level of injury and without circulation the part may not survive. These injuries if not recognized in time may result in loss of limb or function in the limb.

These injuries where circulation is compromised can be adequately treated with microvascular reconstruction of the damaged arteries or veins. Thereby restoring circulation and function.

Another major problem with injuries is **large soft tissue loss with** exposure of bone , Exposure of joint, Exposure of the nerves or any other vital structures. Microvascular free tissue transfer with help of microsurgery helps in excellent soft tissue coverage of vital structures like bones joint, tendons vessels and nerves. Which prevents or decreases chances of infection and promotes faster healing. Excellent patient recoveries are possible with incorporation of microsurgery in the armamentarium of trauma reconstruction.

#### **MICROSURGERY IN NERVE INJURIES**

**Nerve injuries** are another major problem faced in



accidents often causing loss of function in the limb. With the advent of microneural surgery it is possible to repair the injured nerves and bring back useful function and sensation.

Brachial plexus injuries, peripheral nerve injuries in both upper and lower limbs can be effectively repaired to bring back useful function in a paralysed limb

In the face – **Facial nerve injury** loss of facial animation can be very disturbing leading to social isolation and depression. This can be addressed with facial nerve repair or microsurgical functional muscle transfer to restore facial reanimation or bringing back smile on the face. hypoglossal nerve injury, recurrent laryngeal nerve injury.

**Brachial plexus injuries:** Brachial plexus is a network of nerves which supplies the upper limb. It may be injured at birth (obstetric brachial plexus injury) or due to accident resulting from hyperstretching of the neck and shoulder resulting in rupture of avulsion of the nerve roots. This injury is very disabling and leads to monoplegia with loss of function in the upper limb. This can be addressed with brachial plexus repair. This requires microsurgery for joining small nerves, nerve grafting and sometimes doing a functional muscle transfer for restoring function.

**Peripheral nerve injuries** require microsurgical intervention for repair of the nerves either primarily or with nerve grafts. Repair of peripheral nerves under operating microscope with help of microsurgery helps in recover function and sensation. Nerves which are commonly repaired are Median nerve, Radial nerve, ulnar nerve, musculocutaneous nerve, axillary nerve, sciatic nerve, common peroneal nerve, digital and common digital nerves

### MICROSURGERY IN CANCER

Oncological reconstruction post cancer reconstruction is another major area where microsurgical reconstruction is required. This may include,

- **Bone reconstruction** with Osteocutaneous fibular bone free flap for mandible and maxillary reconstruction. For long bone reconstruction
- **Soft tissue reconstruction** – for lip, cheek, nose, forehead and scalp can be accomplished with microsurgical tissue transfer. When large areas of soft tissue require to be reconstructed. Microsurgical reconstruction helps achieve a good aesthetic and functional outcome, restores form and function
- **Functional muscle transfer** – for Tongue, lip or facial reanimation following ablation or nerve injury also is done with microsurgery to restore function.
- **Breast Reconstruction** – breast cancer remains one of the most common cancers affecting women, often leads to resection of breast tissue causing

deformity of the breast or chest region. Microsurgical reconstruction of the breast has become an established method of reconstruction and rehabilitation of the breast cancer patients. It not only restores form of the breast, but also helps in achieving early chemotherapy and radiotherapy after surgical resection.

- **Bone cancers.** – where limb salvage is planned often require microsurgical reconstruction of the bone and soft tissue to help in salvaging a limb from possible amputation.

### MICROSURGERY IN LYMPHATIC RECONSTRUCTION

With the advent of super microsurgery, many areas where reconstruction was thought to be futile are now considered feasible. Lymphatic reconstruction is one such aspect which involves repair of lymphatics,

1. lymphaticovenous anastomosis
2. vascularized lymph node transfer

along with manual lymph drainage have become mainstays in the management of Lymphedema, now a days pro-active lymphatic repair and lymphatic channel preservation is also being done whenever there is inguinal or axillary lymph node resection

common areas where lymphatic reconstruction is being done are:

1. Lower limb lymphoedema-filarial, congenital or acquired
2. Upper limb lymphoedema – post radiation or lymphnode dissection
3. Genital lymphoedema – post filarial or idiopathic

### MICROSURGERY IN BURN RECONSTRUCTION

Burns especially deep electrical burns result in deep wounds secondary to electrocution with exposure of vital structures. These often require microsurgical reconstruction, The most common areas where reconstruction is done with microsurgery in burns are,

1. Large scalp defects
2. Hand burns
3. Post burn contractures
4. Deformity correction in burns

### Surgical requirements

Microsurgery requires few surgical instruments but require to be of high quality. These instruments are quite delicate and expensive.

Microsurgical scissors, Jewellers forceps, vessel dilators and vessel clamps are a few of them. Maintaining good quality and taking good care of these instruments are vital for a good microsurgical surgery. Operating microscope is one of the essential theatre requirements for microsurgery, we would recommend every hospital to have an operating microscope so that patients can benefit from microsurgical reconstruction.

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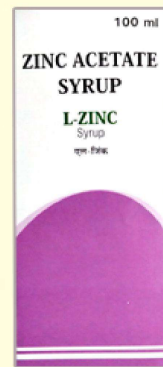
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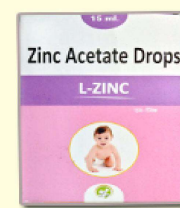
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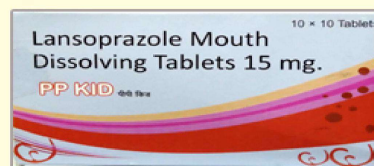
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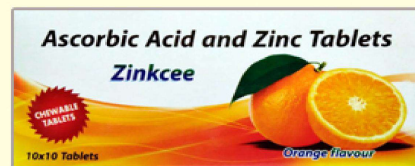
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