CHAPTER

1

History of Liposuction

Aniruddha Bose and Anup Dhir

'Every silver lining has a dark horizon'.

No discoveries in the world have occurred, without the pain of childbirth. The joy that fills its aftermath is worth the pain endured. The baby is left to face the difficult world as the new-born creeps out of the mother's womb.

Like the Laws of Nature, scientific progress passes through the same course. Body contouring was a myth a century back. Physicians confronted with cases, attempted to try new techniques to solve the issue, not without problems and complications. In their zeal and audit, new techniques emerged, which replaced the initial ones.

In medicine, there is nothing absolute. It is a dynamic process of evolution (Fig. 1.1). So has been the case with liposuction.

In this brief treatise, the development of the techniques is highlighted with personal experiences, in the process of evolution. Without being judgmental the liberty has been taken to highlight personal views regarding the procedures in the evolution process. Time is the best judge and in the process of that change, at one stage we fall out from the on-going developments. It has been tried to enumerate the developments till date. Over years further developments will occur and this treatise has to be re-edited keeping at par with future developments.

Liposuction is now solely under the domain of Plastic Surgery, was a wee bit different when it was born. It is interesting to note that liposuction was discovered by two Italian Gynecologists, father and son duo, Arpad and Giorgio Fischer in 1974, attempting to convert the curette to a cannula, which would allow them to suck fat in-between major blood vessels.

Though they are considered pioneers of liposuction, the history dates back to 1921, when a French surgeon Dr Charles Dujarrier attempted to suck fat. Being a French Gynecologist whose patient, a female dancer wanted to improve the shape of her knees and ankles. It was attempted by Dr Charles Dujarier to use the uterine curette used in those days for Dilation and Curettage (D&C), using it subcutaneously from her knees and ankles. But during the process it resulted in damage to the femoral artery which is a subject of speculation for any surgeon. If it was to be believed that he was attempting to suck fat of the knees through inguinal region, it must have been the wildest of dreams for any surgeon, specializing in female reproductive organs. This damaged the femoral artery resulting in gangrene of the leg, which had to be amputated. Dr Charles futile adventure put to an end to attempts, beyond the known.

Pitanguy in the 1960s started doing dermolipectomy, which was removing en-bloc, excess skin and fat for cases of lipodystrophy. That did serve the purpose, nevertheless, leaving ugly scars at site of operation. However, it remained the best alternative of removing excess fat by 'excising' the fat and not 'sucking' the fat.

The suction re-emerged again with two gynecologists, Arpad and Giorgio Fischer in 1974, working in Rome, who used blunt cannulas to suck fat in-between blood vessels by the 'dry' technique. They crisscrossed the movement of cannulas from multiple puncture areas and popularized it as 'Liposculpture'. The results were superior to Pitanguy's technique of resection and left less unsightly scars as they were through puncture holes. Soon seroma and hematoma greeted them, to re-think on their adventure. Later Meyer in 1978, attempted to do the same again with sharp curette, with worse results, and soon use of these sharp cannulas fell into disrepute. Sometimes we do jump into new techniques without thinking of the side effects.

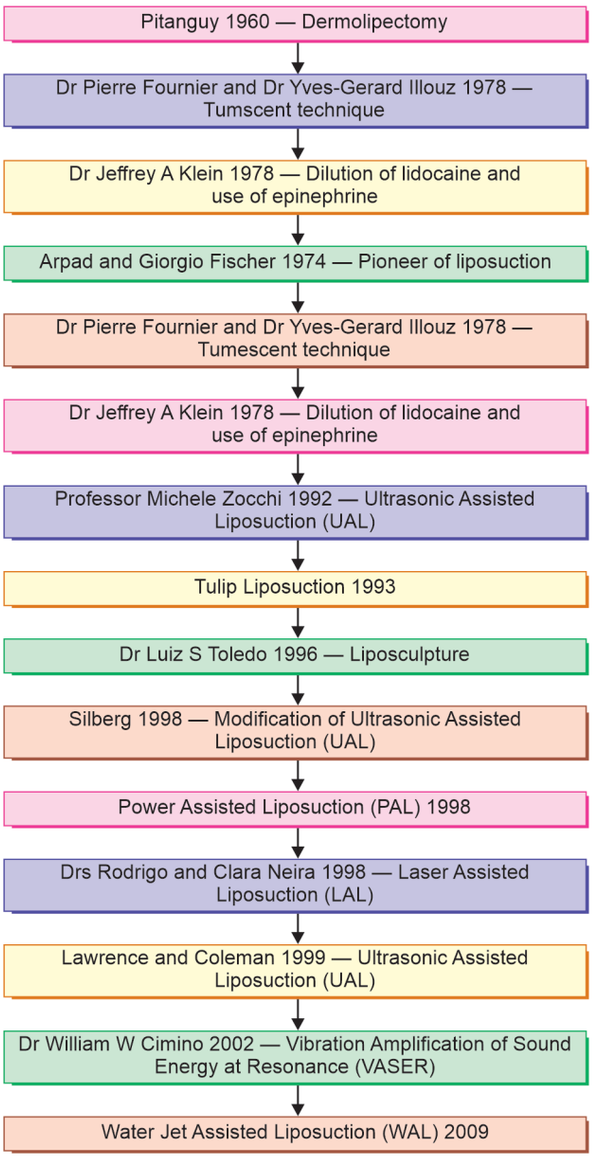

Fig. 1.1: Evolution of liposuction

A sharp curette attached to cannula is bound to damage the blood vessels resulting in hematoma.

At around the same time, Dr Pierre Fournier and Dr Yves-Gerard Illouz became interested in Fisher's ground-breaking work. Dr Pierre Fournier improved on Fisher's limited stab wounds to give a better contour, by making several stab wounds. He also introduced the use of local anesthetic lidocaine, to lay the foundations of Illouz's 'tumescent' technique, topping it with use of compression, to obliterate the dead space, which is the refuge of hematoma and seroma, attempting to give a better contour to the areas operated.

However, it was Dr Yves-Gerard Illouz who introduced the tumescent technique of liposuction in 1978, which is the technique in vogue today. Before the technique is described in detail being in close association with Dr Illouz, lot of new technical aspects of cosmetic surgery was learnt. An unassuming genius, had creative ideas even over a lunch on break. Dr Yves-Gerard Illouz taught all the variations devised for umbilicoplasty during lunch in Paris. Dr Illouz chuckled, "The French ladies love their belly button and so the Greek and Turkish belly dancers". Picking up the paper napkin from the table, started drawing his methods of the variations of making new belly buttons, as per choices of patient. When it came to liposuction, Dr Illouz would say in his French English, "Either you sweat or the patient sweats" obviously indicating the difference between 'dry' and 'wet' techniques.

Popularizing liposuction in a sensible way, Dr Illouz is attributed as pioneer of modern liposuction. He popularized the tumescent or the wet technique. This is injecting normal saline to the areas of liposuction, distending the skin and preserving the neurovascular bundles in the fat septae, to nourish the overlying skin. Fournier and Dr Otteni endorsed the idea of Ilouz by a honeycombed suction lipectomy with a blunt cannula. Their combined efforts shaped the pivot of modern liposuction, which is mixing saline with lidocaine and injecting to the areas marked for the procedure, breaking the fat septae by blunt dissection of the cannula, before the procedure.

But it was not hunky-dory (means satisfactory), though they popularized the technique worldwide. Two years down the line, it fell into disrepute due to negative publicity, with many patients experiencing excessive bleeding and stories of 'rippling' of skin. Dr Jeffrey A Klein, a dermatologic surgeon in California overcame this in 1987, with introduction of epinephrine, with the already introduced lidocaine solution by Fournier, to the tumescent technique of Ilouz, rounding up the story of the progression of liposuction.

Until then, liposuction was done under general anesthesia. Americans prefer local anesthesia for several cosmetic procedures, as an office procedure, which a British colleagues would joke as "General anesthesia without intubation". It reduces the costs and the expertise of an anesthetist, who has to be adequately remunerated.

In use of lidocaine with epinephrine, Dr Jeffery Klein was limited to its maximum dose of 7 mg/kg body weight. His first patient was a lady, with transverse hysterectomy scar, having an overlying fat deposit over the scar. Dr Klein initially used the commercially available 1% lidocaine with 1:100000 epinephrine, sucking 100 mL of fat. Though it was a painless procedure, there were some side effects of epinephrine. He began further diluting the epinephrine with his subsequent patients, noting waning of complications, as he increased the volume of fat sucked. Eventually he settled for 0.05% lidocaine,

1:100000 epinephrine and added 10 mL of sodium bicarbonate to a liter of normal saline. This cocktail reduced the blood loss, infection (partially due to bacteriostatic properties of lidocaine) and provided a smoother post-operative course in his office procedure. Later in 1990, he showed by measuring its plasma levels, this cocktail 35 mg/kg of lidocaine could be used, instead of the traditional 7 mg/kg, during the procedure. It also confirmed, the gradual absorption of lidocaine, when mixed with the tumescent fluid, was different than normal conditions.

The epinephrine introduced, shrunk the capillaries and bleeding was less, leading to increased popularity of the procedure for ladies wanting to sculpture their buttocks and thighs, marking its steady progress into evolution of various equipment for the procedure.

Modern general anesthesia is quite safe. In this situation, after introduction of epinephrine, there is no reason, why liposuction should be performed under local anesthesia with lidocaine, even diluted, as an office procedure. Liposuction involves huge fluid shifts and for larger volumes of fat removed, it is imperative the patient is monitored overnight. There seems no sensible medical reason, why it should be used as an office day-case procedure, putting increased risk to the safety of the patients in a cosmetic procedure. The lidocaine can safely be eliminated with general anesthesia, with the cocktail consisting of normal saline, epinephrine and sodium bicarbonate.

Until the 1990s, Suction Assisted Liposuction (SAL) was used for liposuction. Professor Michele Zocchi, an Italian plastic surgeon and physicist, was developing a new method, using ultrasonic waves.

In 1992, he first presented his work on Ultrasonic Assisted Liposuction (UAL) at a scientific meeting in Europe. As it happens with any new evolution, traditionalists, who can never accept any alternatives other than their known paradigms, counteracting it. This has happened over centuries and Zocchi faced its aftermath. Prof Zocchi was badly criticized by most of the European Plastic Surgeons. True, there were some drawbacks with his newly-developed ultrasonic equipment, which caused burns at port of entry, instead of helping his to develop the technique, he was shown the door by most of dominant plastic surgeons of Europe, without assisting him in development of modifications of the machine to overcome the complications. Professor Michele Zocchi's UAL was not accepted and SAL held fort, in the liposuction scenario.

A year later, Tulip Medical came up with a cheaper alternative, based on the suction principle by creating vacuum in syringes with a Standard Luer Lock to standard 50 mL syringes, introducing blunt cannulas to suck the fat to syringes. Under the sponsorship of Mentor, me with my boss Mr Malcolm Deane, FRCS, introduced this technique to British Plastic Surgeons, as an adjuvant to Madeline Lejour's technique (an improvement from Lassaus technique) of breast reduction. Demonstrating its role in also in small areas to fat deposition, at AMI Park Hospital, Nottingham. It was fine for small to moderate areas, but it did tax the physical energy of the surgeon, for larger bulks. Later different varieties of Luer Lock emerged as Smart Hub, SuperLuerLok the latest one being Gems SuperLuerLok.

Professor Michele Zocchi had not given up his hope, in spite of opposition and arrogance from his European colleagues. He formed the International Society for Ultrasonic Surgery. In a meeting in Algrave, Portugal in 1995, Zocchi presented the modified version of his modified machine, which eliminated the complications, for which he was criticized, to a handful of surgeons from Europe, the Middle East, and Latin America and a few from America. Being present at that meeting too could see a silver lining to the newly developed technique, in spite of the negativity of the European Plastic Surgeons. Hassane Tazi from Casablanca substantiated his modification and theory with his presentation. It included clinical presentations of original scientific research, complementing with an endoscopic video material, giving us a unique internal view of ultrasonic activity at a cellular level.

Dr G Patrick Maxwell from Nashville, Tennessee, more interested in breast surgery at that time, thought Zocchi deserved a fair chance and organized for Zocchi to operate on his patients in Nashville from 1996, with approval of FDA, and the major plastic surgery societies and insurers. By 1997, it became an accepted procedure and was taking over the mantle of liposuction as new emerging technique of SAL.

The earlier complications as severe burns, seromas and injury to peripheral nerves were eliminated by newer developments of the machine, but some surgeons advocated that UAL was risky in certain areas as arms, face, neck, inner thighs, knees and even saddle bags. They also specified ultrasonic energy produces dangerous free radicals. The original equipment demonstrated by Zocchi, now included changes made by him in cannula design, introducing titanium ones and pulsed energy mode generators. The basis behind pulsed energy devices is to limit ultrasonic energy delivery to the tissues, to avoid burns. Limitation of pulsed energy slows the procedure, resulting in longer operating sessions.

They also started using it for treatment of cellulite. Newer forms of its treatment came with using Toledo dissector, which is a V-shaped dissector for severing the retinacula cutis, by Dr Luiz S Toledo, giving birth to another nomenclature of liposuction 'Liposculpture'. Liposuction ought to be done deeper than 1 cm from skin. The new proponents, by introducing the term Liposculpture, started advocating superficial and deep liposuction, the superficial ones for correction of cellulite with the aid of the Toledo dissector, not without adverse effects as skin necrosis, hematoma, etc. It soon fell into disrepute.

The initial UAL now emerged with a new facelift–the external UAL. Silberg in 1998 modified the concept accepting the UAL by introducing it through machines with transmission of high frequency of 2–3 MHz, supported by Lawrence and Coleman in 1999 and Lawrence and Cox in 2008. Ferraro confirmed the destruction of adipose tissue histologically in 2008.

Cosmetic Surgery is a lucrative money-spinner. Everyone wants to lay a hand on the cherished pie. While surgeons were busy developing and refining techniques, the non-operating dermatologists felt they needed to have their fair share in the business.

The original mesotherapy developed in France in 1952, became a weapon for nonoperating doctors, to enter the realm of obvious treasure. So a parallel treasure hunt rekindled, by bringing in mesotherapy, to the forefront. The technique involves injecting various medications most of them containing phosphatidylcholine mixed with a common solvent deoxycholic acid (gallic acid) into mesoderm. This started with non-operating dermatologists trying to revive and popularize this non-invasive technique, from the archives of 1952. Not only it gave unproductive results, but was verminous with complications as scars, cutaneous granulomas, folliculitis, mycobacterial infections and ulcerations. It was not accepted as an alternative to standard established procedures.

Nevertheless, they were not prepared to lose the battle with qualified surgeons. So fancy 'spa' techniques evolved. A variety of mechanical devices came up for reduction of localized fat. Among these were the ionithermie, which consists of galvanic musculo-electro-stimulation, combined with algae, seaweed extracts, amino acids, and hops in a thermal clay occlusion. Other mechanical devices as Endermologie were tried to improve contour by mechanical effect of deep tissue massage. Light-based lipolysis, which includes diode 'cold' lasers such as Zerona induces a photochemical cascade, targeted at fat cells, to cause a transitory pore in fat-cell membrane. Triactive combines 6 diode lasers with massage and cooling. This was topped with radiofrequency, to correct the wrinkled skin. Cryolioplysis freezes the lipids in the fat cells, which then slowly dissolve without trauma to surrounding tissues. None of these fancy adventures could replace the evolution of the surgical techniques and became a fancy tool of cowboys, desperate to enter the panorama of commercial endeavors.

Still attempts go on to get a grasp of the body-contouring milieu. Two external devices both based on High Intensity Focused Ultrasound (HIFU) are currently being tried, to regain lost grounds. One such is LipoSonix, which attempts to break the fat, engulf the lipids and cell debris with macrophages and eventually reduce the fat volume. The other one is Ultrashape, which focuses ultrasonic energy at a controlled depth using a nonthermal Laser Assisted Liposuction (LAL) pulsed wave (akin to linear accelerator). It claims at selective fat disruption sparing skin, vessels, nerves, or connective tissue.

As science progresses with its crests and troughs, non-surgeons will prod on to get a grasp of the money-spinning market with their innovative ideas targeting the populace sceptical on surgery. Only time can decide, which stands the test of time, though until now, all these attempts have been a miserable failure.

With UAL yet to reach perfection, in 1997 the Power Assisted Liposuction (PAL) entered the scene, offering a more satisfying alternative. It uses high-speed reciprocating cannulas, which produces fewer complications than UAL in quicker time, with easier entry even in dense and fibrous tissues. It is more precise, allowing direct targeting of specific areas, with fast recovery of patients. This is a preferred technique even now, though other techniques are nascent, evolving.

During these years, two Columbian Plastic Surgeons Drs Rodrigo and Clara Neira had been working since 1997 with laser, to reduce the pain and inflammation, after traditional liposuction. They discovered, if lasers were applied prior to suction, the fat cells became softer, easier to extract, thereby reducing post-operative discomfort. They presented this as LAL in 1998. It was more of an adjuvant to the traditional procedures. The physical force of the cannulas trying to pierce septae into adipose zones of the other traditional procedures was traumatic to the body, damaging the internal connective tissue, blood vessels, and other surrounding tissue. The use of laser prevented this damage. An optical laser fiber, as thin as human hair, is used to melt the adipose cells, the fibers slicing the target areas with extreme precision, sparing adjoining tissues. The liquefied cells are removed by suction. Different companies market this product under different names, which are variations in the wavelength. These came into practice in 2009.

Trade name	Laser type	Wave length
SmartLipo	Nd:YAG	1064 nm
SlimLipo	Diode	924 nm, 975 nm
LipoLite	Nd:YAG	1064 nm
ProLipo	Nd:YAG	1064 nm, 1320 nm
CoolLipo	Nd:YAG	1320 nm
SmartLipo MPX	Nd:YAG	1064 nm, 1320 nm

Other alternatives as Lipolite, LipoTherme and LipoControl are mere variations of the same principle.

Following the footsteps of Zocchi, the Italians have always attempted at new methods of liposuction. They came up with a new technique called Laser Lipolysis. Here after injection of tumescent fluid a fibro-optic device is introduced. The laser light beamed through the fibro-optic device has an affinity for

yellow material, here being the fat, which emulsifies. It can liquefy moderate amounts of fat.

Water Jet Assisted Liposuction (WAL) uses a pressurized stream of saline to dislodge fat and remove fat cells. Instead of destroying fat cells, it loosens them up to facilitate easy removal more popularly known as **Body-Jet Liposuction** by Eclipse making its appearance in 2009 to add another technique to the ongoing liposuction saga.

The UAL had not died in the process of development of the other techniques. Behind the scenes, it was undergoing a radical metamorphosis. Though Dr William W Cimino, founder of Sound Surgical Technologies LLC, was developing this method from 1998, it came to surface in 2002 with the third variation of UAL, the Vibration Amplification of Sound Energy at Resonance (VASER) System, which was capable of emitting intermittent or continuous bursts of ultrasonic energy, by sound medium, through a pulsating probe to break the fat cells, which are subsequently sucked out. This prevented overexposure to ultrasonic waves and less of its side effects. The technique is more precise, as it spares the cells essential to the body, liquefying the rest, with minimal damage to remaining tissues. This can remove thrice the amount of fat, by other techniques, is quicker, more accurate with a fast recovery time with low incidence of bruising, bleeding and other bodily trauma in addition to tightening the skin around.

The evolution of medicine is a dynamic process shifting its parameters with each developmental step. This ongoing progress will lead to further development of newer techniques. What is prevailing today might be a history tomorrow. Even with the growth of the science the newer techniques emerging, the role of the pioneers in the history of liposuction will always persist. Maybe the techniques described today, become obsolete over the years, but looking back at the development of the science, the people who have contributed will always shine in our mind, when we fathom the archives, from where it initiated.

Newer techniques may evolve replacing the ones in vogue, but the basic principle behind the development of these techniques, will always be appreciated, even if they are discarded with its development. Science has rationality. It is the rationality of the science that is of prime, than which techniques play a significant role over a particular period.

In a humble discourse on the history of liposuction, it was tried to enumerate those principles, in reference to the names initiating the concept. While over the years, with further development of science, this treatise may seem as a reference, yet it will give a clear picture of the evolution of liposuction to the present.

With the emergence of new silver linings, it may unveil the dark clouds that accompanied its growth and progress over time.