

Original Article

Current trends of liposuction in India: Survey and Analysis

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ABSTRACT

Background: Liposuction is the commonest aesthetic procedure performed by Indian plastic surgeons. However, there exists substantial disparity amongst Indian surgeons about guidelines concerning liposuction. To address this disparity, a nationwide email survey (Association of Plastic Surgeons of India [APSI] database) was started in December 2013 and continued for 5 months. **Material and Methods:** The survey was developed with software from www.fluidsurveys.com. The study was designed to cover most aspects of patient selection, perioperative management, technical considerations, postoperative management and complications. This is the first survey to be conducted in India for an extremely popular procedure. It is also one of the most exhaustive surveys that have been conducted in terms of the topics covered. **Results and Conclusions:** One hundred and eighteen surgeons (including a majority of the cosmetic surgery stalwarts in the country) completed the survey. As expected, the results show a disparity in most parameters but also consolidation on some issues. Liposuction is considered extremely safe (86.1%). The majority of surgeons (70.3%) aspirated >5 L at onetime. The majority (80.2%) felt that the limits for liposuction should be relative and not absolute. The survey highlights lack of standardization with respect to infiltration solutions. The commonest complications observed were contour irregularities, followed by seroma and inadequate skin redrape. The amount of aspirate is the only factor, which achieves statistical significance with respect to major complications. A review of the current evidence and recommendations has been incorporated, along with an in depth analysis of the survey.

KEY WORDS

Complications; India; liposuction; survey

INTRODUCTION

Liposuction is the commonest aesthetic procedure performed in India.

A combination of rich food, sedentary lifestyle and a peculiar body habitus predisposes the Indian

population to accumulation of significant fat deposits. In addition, fascination for minimally invasive procedures and reluctance for scars make liposuction the procedure of choice for body contouring in Indian patients.

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Increased demand coupled with media-fed images of scarless surgery with minimal downtime has resulted in liposuction being perceived as a procedure without complications. Hence, some adventurous non-surgeons perform it in conditions far from safe and no knowledge of tackling complications.

Liposuction and aesthetic surgery in India are still in an early phase. For such a commonly done procedure, the common expressions we hear in discussions about the extent of liposuction are “calculated guess” and “in my opinion”, both of which suggest ambiguity. To address these issues, a nationwide email survey was initiated, which covered all aspects of the procedure.

MATERIALS AND METHODS

The survey was designed by software from www.fluidsurveys.com. It covered all aspects of liposuction including patient selection, perioperative management, technical considerations, postoperative management and complications. It comprised 50 questions that could be completed quickly.

The software generated a unique id for each respondent such that data was not duplicated. The software also allowed respondents to edit their choices before final submission. The data was analysed by software that was inbuilt into the program. The software collated data only when the surgeon answered at least 70% of the questions in the survey.

The survey was kept active for 6 months.

A total of 3,897 emails were sent, which included 2,045 invitations with 1,852 reminders. There were 118 responses.

Aims of the survey

1. To assess awareness amongst surgeons regarding evidence-based guidelines for liposuction.
2. To evaluate the profile of the Indian patient opting for this procedure and to assess if surgeons adhere to the 5-L (total aspirate) limit at one time.
3. To evaluate if surgeons felt that the limits for liposuction should be relative rather than absolute.
4. To evaluate the true incidence of serious complication rates and identify the possible causes.

RESULTS AND ANALYSIS

General aspects

Liposuction is the commonest aesthetic procedure (65%) performed by respondents who completed the survey [Figure 1]. The mean number of liposuction cases performed per year in respondents who completed the survey was 32.5/year. Only 9.4% of the surgeons operated on more than 70 cases annually [Figure 2]. In comparison, surgeons in the US operate an average of 50-100 cases per year.^[1]

There was an adequate representation across all age brackets. On a cross tabulation analysis, it was interesting to note that surgeons with less than 10 years of experience were performing liposuction more frequently than surgeons with more than 10 years of experience [Figure 3].

Preoperative evaluation

The majority of surgeons (66%) operate patients within a body mass index (BMI) range of 25-30 [Figure 4].

Surgeons were also asked about whether they refused patients for liposuction. As expected, being grossly overweight and those having unrealistic expectations were the commonest reasons for refusing patients

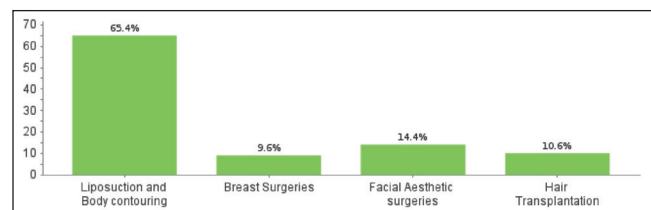


Figure 1: Commonest aesthetic procedure performed

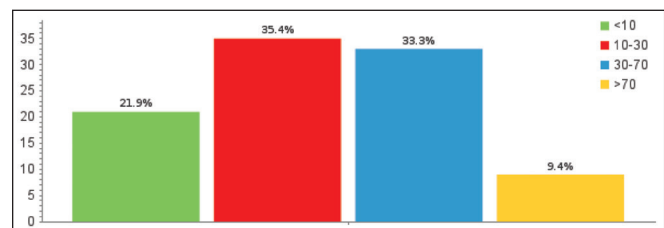


Figure 2: Average number of liposuction cases performed per year

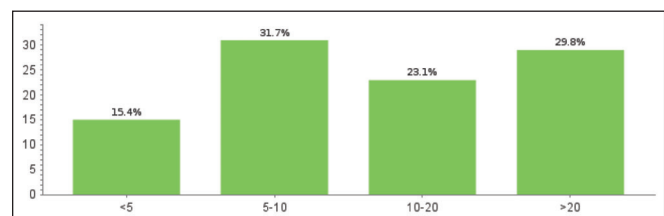


Figure 3: Number of years in practice

[Figure 5]. The majority of respondents chose general anaesthesia (GA) as the preferred anaesthesia [Figure 6].

Perioperative aspects

The majority of surgeons (64.7%) performed Suction-assisted Liposuction (SAL), 25.5% of the surgeons performed power-assisted liposuction (PAL) and 9.8% use Ultrasound/Vaser-assisted devices [ultrasound-assisted liposuction (UAL)] [Figure 7]. The majority (34%) had not used any energy based devices but 21.6% surgeons with experience of multiple devices preferred PAL [Figure 8].

An important aspect, which has been highlighted for the first time by this survey is that the majority of the surgeons (70.3%) aspirated > 5 L at one time [Figure 9]. In concurrence with the above finding, 67.3% felt that the

American Society of Plastic Surgeons ASPS cut-off was too conservative [Figure 10]. 16.2% of surgeons performed megaliposuction > 15 L [Figure 11].

Surgeons were asked about their choice of variables to assess the limits for liposuction.

The majority (80.2%) felt that the limits for liposuction should be relative and not absolute [Figures 12-13].

The majority of the surgeons (>80%) expected a haemoglobin (Hb) drop of <2 g when aspirating 6-7 L [Figure 14]. However, only 43.6% routinely assessed postoperative Hb levels.

85.7% feel liposuction can be easily combined with other procedures and the commonest procedure done in

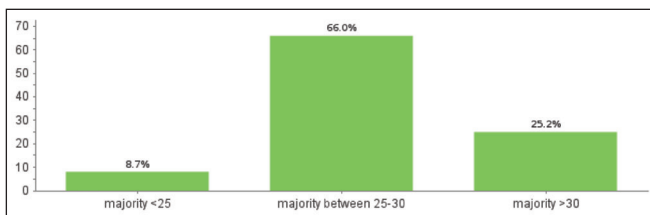


Figure 4: BMI of patients selected for liposuction

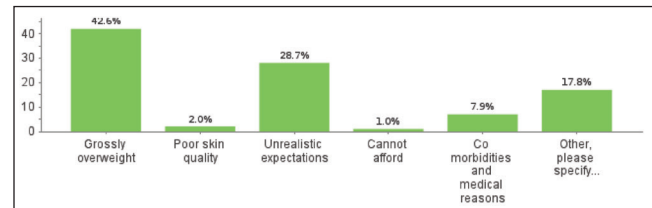


Figure 5: Do you refuse patients opting for liposuction? What are the commonest causes?

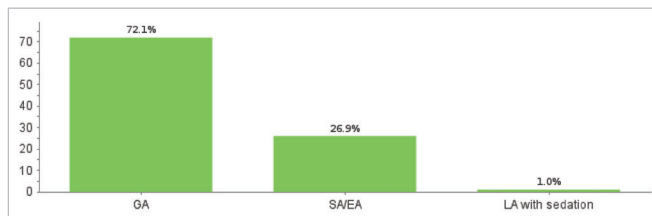


Figure 6: Preferred anaesthesia for liposuction of approximately 5 L (torso/lower body)

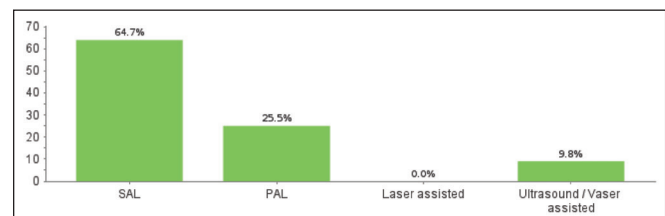


Figure 7: Technique of liposuction

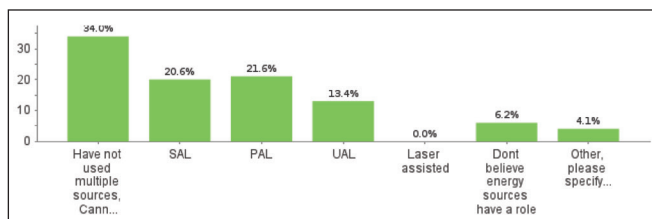


Figure 8: Preferred technique if you have access to all modes

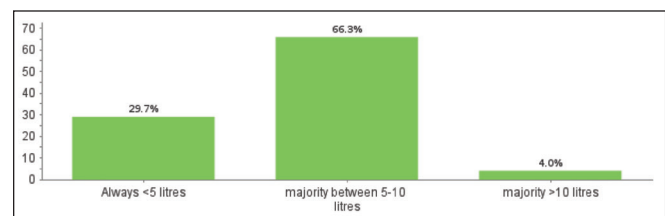


Figure 9: Average total aspirate

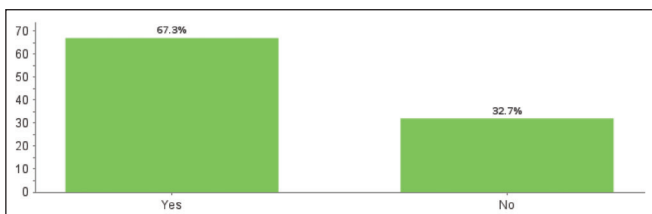


Figure 10: Do you feel that 5 L (total aspirate) cut-off is too conservative? (ASPS patient safety advisory PRS 2009)

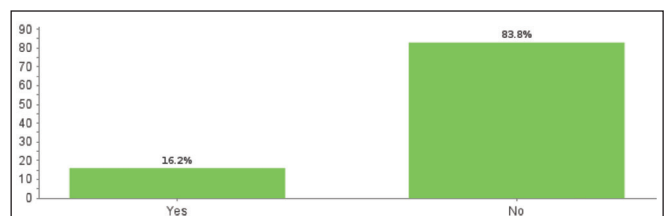


Figure 11: Do you perform mega liposuction >15 L aspirate in one sitting?

conjunction with liposuction is abdominoplasty (90.7%) [Figure 15].

The majority of the surgeons (71.1%) preferred Ringer Lactate as the infiltration solution [Figure 16].

Surgeons were asked to select the preferred infiltration fluid composition.

The majority (32.6%) used adrenaline 1 mg + xylocaine 2% 30 mL + hyalase + soda bicarbonate 10 cc. 18.9% of the surgeons also used varying formulas [Figure 17].

80% of the respondents did not change the composition of the infiltration if volume went beyond 5 L [Figure 18];

the majority (50.5%) infiltrate was more than 5 L for a 38-year-old healthy patient with a BMI of 30 [Figure 19]. When asked about the maximum amount of adrenaline they were comfortable injecting, some surgeons gave a contradictory response (the majority infiltrated more than 5 L, did not change the composition per litre yet felt that adrenaline more than 5 mg should not be used) [Figure 20].

The majority of the surgeons (73.2%) preferred the superwet technique [Figure 21]. Surgeons aspirating <5 L primarily used the tumescent technique. The majority of surgeons, i.e., 61.5% replaced intravenous (IV) fluids based on clinical grounds [Figure 22].

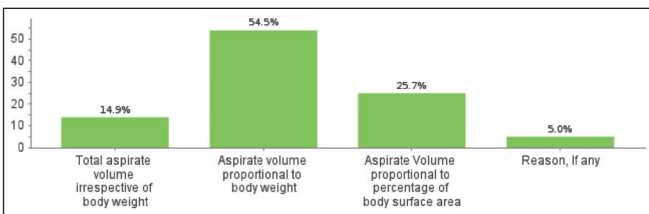


Figure 12: Do you feel that the limits of liposuction should be relative and not absolute? In your opinion, which of these following variables would be a better way to assess the limits for liposuction?

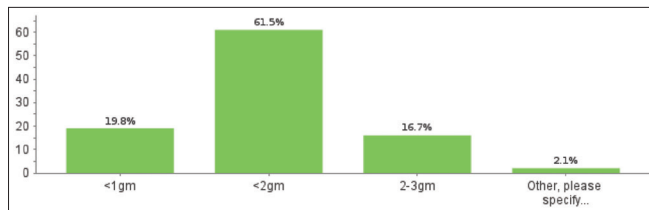


Figure 14: With a total aspirate of 6-7 L, how much drop in Hb would you consider acceptable?

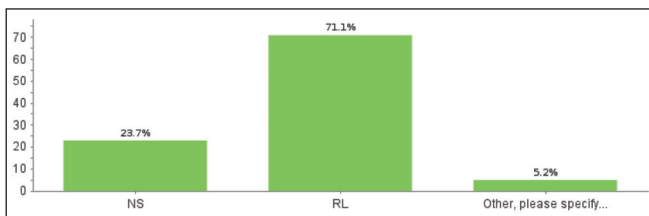


Figure 16: Preferred wetting solution for infiltration

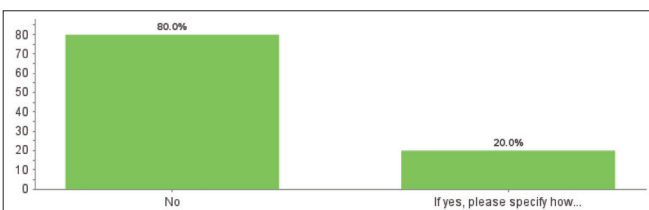


Figure 18: Do you change the composition of the infiltration solution if you are infiltrating more than 5 L?

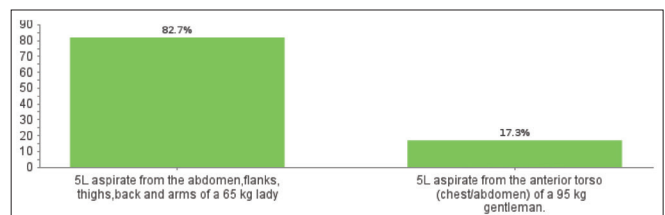


Figure 13: Of the two scenarios below, which would you consider as causing more significant physiological alteration?

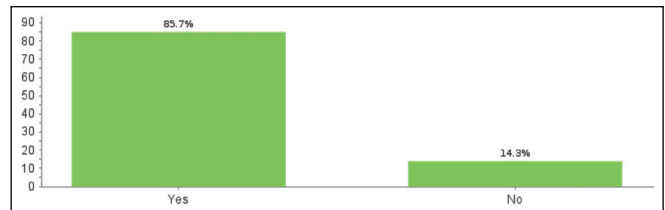


Figure 15: For a healthy 38-year-old patient with a BMI of 30, would you be comfortable combining liposuction with other procedures?

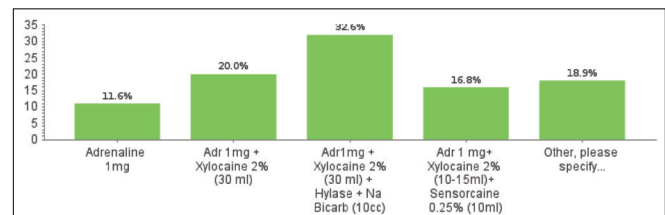


Figure 17: Infiltration composition per 1,000 mL

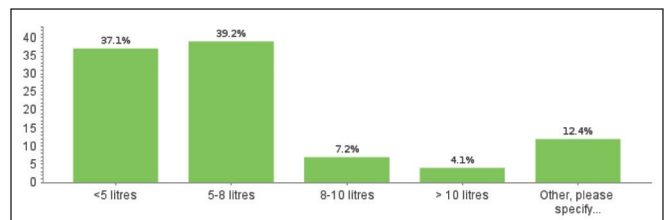


Figure 19: For a healthy 38-year-old patient with a BMI of 30, what would be the maximum infiltrate that you would use?

Postoperative management

The majority of the surgeons, i.e., 76.9% applied the pressure garment immediately after the procedure [Figure 23]; 78.4% felt that the garment should be snug and not excessively tight [Figure 24]. The opinion was divided amongst surgeons as to why pressure garments should be used [Figure 25]. The duration of use was also variable. The majority used it for 6-8 weeks.

Postoperative oedema was managed only by pressure garment(s) by 52.6% of the surgeons [Figure 26]. 28.4% also added manual lymphatic drainage after 1 week. The number of surgeons who used other pharmacological agents or additional mechanical therapies was negligible.

About 53.6% of the respondents felt comfortable in sending the patients home the same day when aspirating

<5 L [Figure 27] but when aspirating >7 L, 87.9% kept the patient overnight [Figure 28]. 77.4% agreed that the incidence of complications would increase when the aspirate was >7 L [Figure 29]. 69.1% also felt that performing an additional procedure increases the incidence of complications [Figure 30].

When asked about complications, the majority felt that the causes were multifactorial [Figure 31]. The commonest complication one observed was contour irregularities followed by seroma and inadequate skin redrape [Figure 32].

Although the majority (81.3%) believed that our mortality rates must be lesser than 19/100,000, 63% also believed that the incidence of serious complications was much higher than reported [Figure 33]. 30.6% surgeons believed that fat embolism syndrome (FES) was responsible for a majority

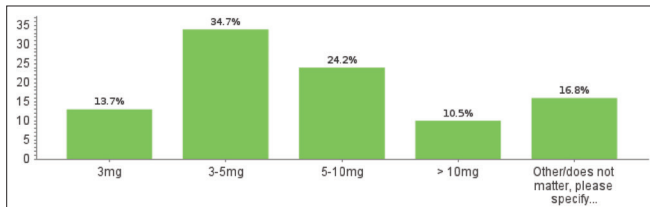


Figure 20: What do you feel is a safe maximum dose of adrenaline that you would be comfortable injecting?

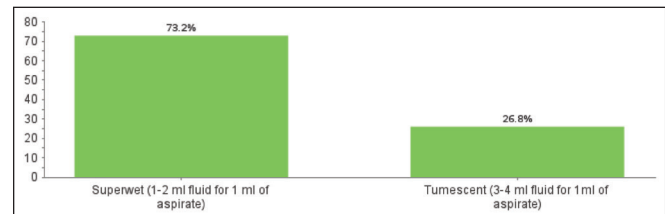


Figure 21: Infiltration endpoint

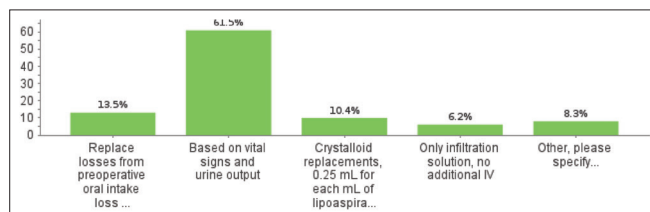


Figure 22: During liposuction, how much of additional IV fluids would you administer?

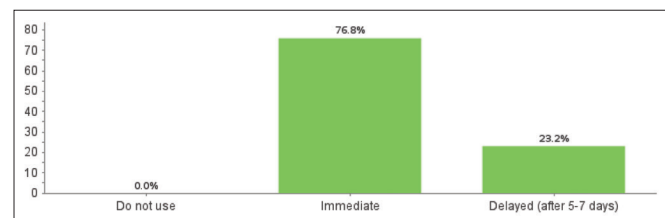


Figure 23: When do you apply the pressure garment?

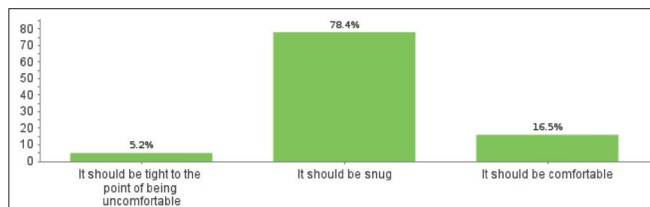


Figure 24: How tight should the pressure garment be?

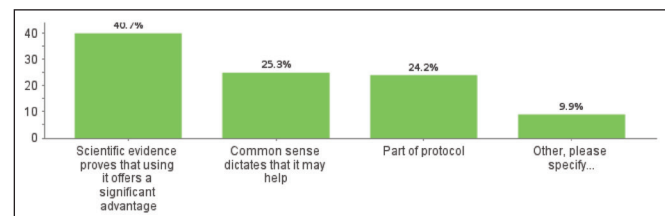


Figure 25: You insist on using pressure garments because

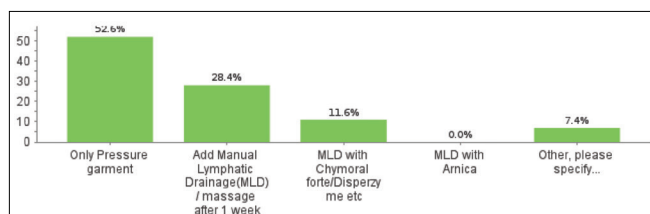


Figure 26: How do you manage postoperative oedema?

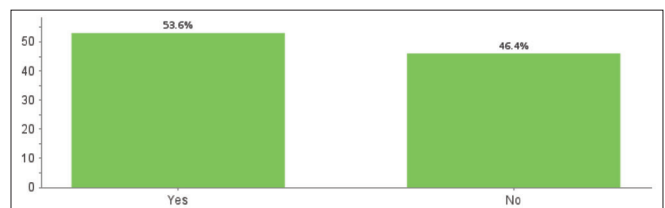


Figure 27: For a healthy 38-year-old patient with a BMI of 30, if only liposuction is performed and aspirate is <5L, would you send the patient home?

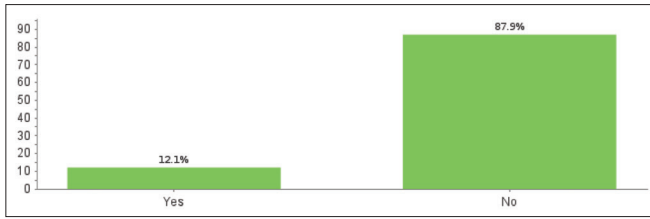


Figure 28: In the same patient if the aspirate is >7 L, would you be comfortable sending the patient home on the same day?

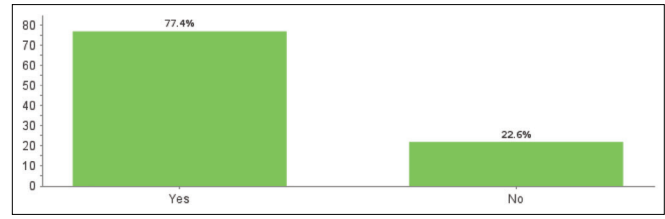


Figure 29: Would you agree that the incidence of fluid overload is higher with increasing volumes of infiltrate (>7-8 L)?

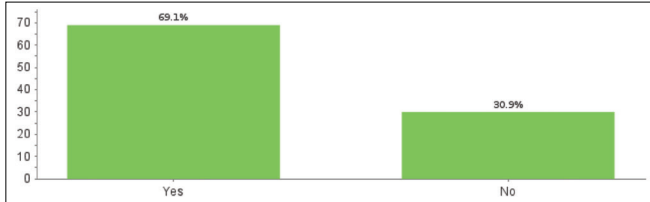


Figure 30: Does the incidence of complications increase when an additional procedure is performed?

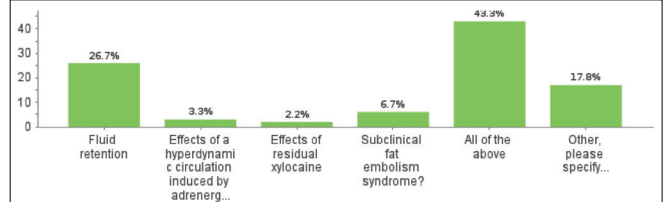


Figure 31: What would you attribute the complications to?

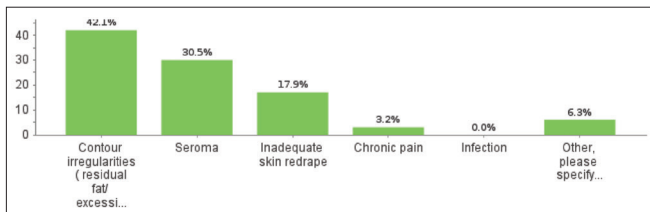


Figure 32: What is the commonest complication you come across after liposuction?



Figure 33: Do you believe that the incidence of life-threatening complications (not leading to death) is higher than reported?

of the complications [Figure 34] followed by pulmonary embolism (20.4%) and peritoneal perforation (19.4%).

Twenty seven surgeons reported having at least one life-threatening complication after liposuction [Figure 35]. It is interesting to note that the number of responses for complications increased from 27.8% to 67.9% when asked if the respondents had managed someone else's complications [Figure 36]. In absolute numbers, 66/118 surgeons had to deal with complications after liposuction. This is a significant number and hitherto one, which has not been highlighted so far.

The majority of the surgeons had a patient satisfaction rate of 75-90% [Figure 37]. On a cross tabulation analysis it was seen that respondents who aspirated > 5 L had better satisfaction rates than those aspirating < 5 L. Unrealistic expectation despite counselling remains the commonest cause for dissatisfaction after liposuction [Figure 38].

DISCUSSION

Liposuction has evolved over the last two decades to be an effective body-contouring tool. It has a reputation

amongst patients and the media for being non-invasive, quick and ideal for obesity.

The basic premise of liposuction is deceptively simple, reduction of localized fat deposits over a large area from small access incisions using hollow metal tubes. The seemingly "simple" procedure is now a well-established body contouring modality and also an adjunct to multiple body contouring procedures.

It is perhaps its technical simplicity and strong commercial pressure that force surgeons to be less objective about evidence-based guidelines.

Despite the popularity of liposuction, there are relatively few high quality objective studies available on the topic. To address this, both the American Society of Plastic Surgeons (ASPS) and American Society for Aesthetic Plastic Surgeons (ASAPS) have been regularly publishing guidelines for physician education and maintenance of certification.^[1-7]

Aesthetic surgery and liposuction are still in an early phase in our country. We do not have our own practice

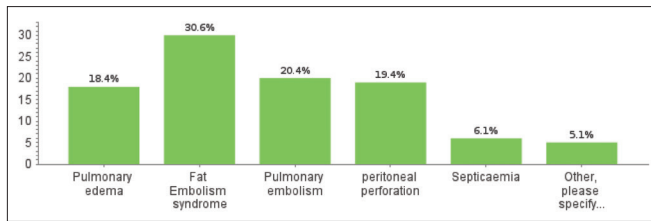


Figure 34: According to you, which of the following would be the leading cause of mortality after liposuction?

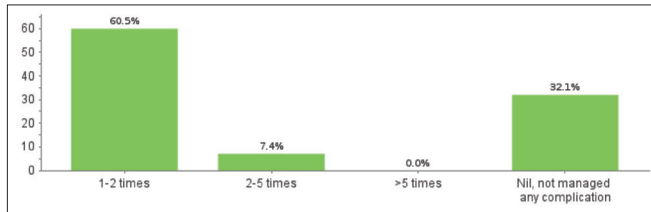


Figure 36: Have you managed your own or someone else's serious/life-threatening complication after liposuction in the last 5 years?

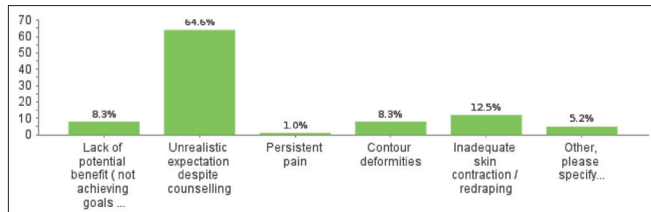


Figure 38: What factors would you attribute to dissatisfaction?

guidelines or a mortality database. Objective assessment of the current scenario of liposuction in our country has not been done till date. This survey was mooted to address this deficiency.

The survey on liposuction was well-received. Most respondents were very encouraging about the initiative. The survey has shown some interesting findings.

General aspects

Liposuction is by far the commonest aesthetic surgery performed by surgeons who have completed the survey. It would be safe to assume that this is the scenario across the country. The overwhelming majority of the surgeons (86.1%) felt that it was a safe procedure. Although our numbers are less at the moment, with increasing awareness and a rising disposable income in our country, it is likely that these numbers would increase.

Preoperative evaluation

The majority of surgeons in the survey selected patients with a BMI between 25 and 30. However, 25.2% of surgeons also operated on patients with a BMI of more

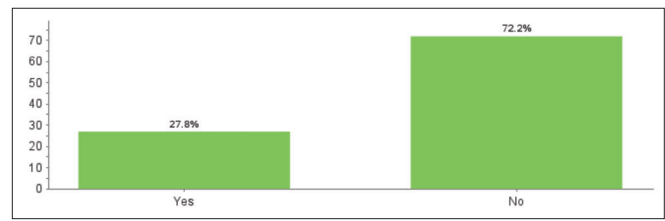


Figure 35: Have you had a serious/life-threatening complication after liposuction?

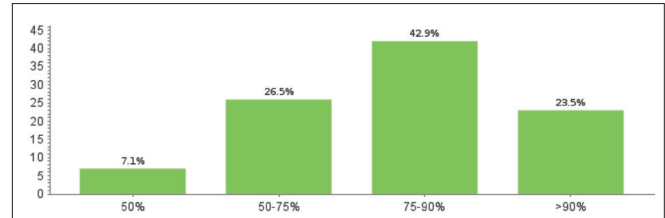


Figure 37: In your practice, the % of patients who are satisfied after liposuction is

than 30 [Figure 4]. On cross tabulation analysis, it was evident that this number decreased with increasing experience with the procedure. Surgeons who performed between 10 cases and 30 cases a year operate about 45.8% of patients with BMI of more than 30. This number reduced to 8.3% for surgeons who performed more than 70 patients annually. The change in the profile of patients (from BMI >30 to BMI <30) shows a better understanding by the experienced surgeon in choosing patients in whom the results can be achieved with consistency and minimal risk.

Although only a minority (16.2%) among surgeons performed mega liposuction [Figure 11], it was observed that of the 16 respondents who perform megaliposuction, 13 (71.2%) are surgeons who operate on <70 cases annually. Also, in this subcategory of surgeons, the incidence of complications is high; 10/16 of these surgeons have had complications.

While liposuction may provide some benefit to the obese patient, inherent risks in these patients must be considered such as fluid imbalance, poor wound healing, increased risk of infection and deep vein thrombosis.^[5,8] Currently, there are no consistent guidelines about the preoperative selection of patients.^[2]

Perioperative aspects

Technique of liposuction

SAL is the preferred method of more than half of the respondents, which is similar to the surgeons in the US.^[1] An additional finding in the survey is that 21.4%

of the surgeons who have experience with multiple devices prefer PAL. Although not definitive, PAL has been shown in some studies to be more efficient in fat removal than SAL.^[9,10] There have been very few prospective studies, which have compared aesthetic outcomes from different techniques. In one of the largest studies till date, Triana *et al.*^[11] did not find any difference in the aesthetic result by using different devices. Lately, in the US, there has been a trend of shifting back to SAL from energy devices (PAL/UAL). Rising costs, time and patient safety were the reasons mentioned for the shift to SAL.^[1]

Anaesthesia

The majority of the respondents preferred GA. No single technique of anaesthesia has been proven to be superior over others. However, the practice advisory on liposuction does recommend avoiding epidural and spinal anaesthesia in office-based settings because of potential hypotension and volume overload issues.^[5,6,12]

Volume of aspirate

An important finding in the survey (one of the objectives) is that the majority of the respondents (70.3%) aspirate >5 L at one time. This may represent indirect evidence of the difference in profile of patients we treat in India, compared to the west. Our notions of beauty and acceptance of fat deposits are different from that of the West. Our patients seek help when the deformity is fairly excessive and are generally unhappy with the removal of small amounts of fat.

67.3% of respondents felt that a 5-L cut-off was too conservative. Similarly, the overwhelming majority of surgeons (>80%) felt that the limits of liposuction should be relative rather than absolute. Surgeons also concurred that both the body weight and body surface area (BSA) treated are important factors in physiological alterations after liposuction [Figure 13].

Although nowhere is it categorically mentioned that the limits of liposuction should be relative, it is probably prudent to recognize the collective opinion of the surgeons performing the procedure while forming guidelines for the procedure in our country.

Adjunctive procedures

The majority of surgeons feel liposuction is a safe procedure which can be combined with other adjunctive procedures like Abdominoplasty. On the other hand,

the majority (69.1%) also felt that adding a procedure increases the incidence of complications. This represents a dichotomy of sorts where surgeons are aware that adding a procedure increases the incidence of complications yet feel that it is safe and do so anyway. After a survey on board-certified members of ASAPS, Hughes^[13] reported a significant increase in complications when liposuction was combined with other procedures, especially with abdominoplasty. Restriction of liposuction in combination with other procedures continues to be debated due to the anecdotal nature of the data. At this point, some states in the US impose restrictions pertaining to aspirate volume and surgical facility. For example, in Florida, USA, for combined procedures, the cut-off for volume of supernatant fat is 1,000cc; in Tennessee, USA the limit is 2,000 cc.^[14,15]

Wetting solutions

There is a complete lack of standardization with regard to wetting solutions used by Indian surgeons.

It is worthwhile to look at each of these components with respect to current levels of evidence.

Xylocaine

Xylocaine was an important component of the original Klein's formula.^[16] The majority of these cases were performed under local anaesthesia. Recent data suggest that for patients undergoing general anaesthesia with the superwet technique, the xylocaine component may be reduced and/or eliminated without postoperative sequelae of increased pain.^[17,18]

Pharmacologically, the effect of 2% xylocaine used undiluted in the skin and subcutaneous tissue lasts for 1-2 h. Since most liposuction surgeries last for more than 1-2 h, it is difficult to understand as to why 0.006% of xylocaine will act for a longer time and offer pain relief postoperatively. The author and his colleagues have stopped using xylocaine since the last 2 years and did not find any change in the postoperative pain levels.

In the survey, 78.4% of the surgeons reported that they continued to add xylocaine even when the procedure was performed under GA.

The safe level of xylocaine in tumescent solutions has been established by Klein^[16] and others at 35 mg/kg concentration, as referenced by Kenkel *et al.*^[19]

Xylocaine 2% is available in India in 21.3 mg/mL (LOX, Neon laboratories, 140, Damji Samji Industrial Complex, Mahakali Caves Rd., Andheri (East), Mumbai-93). So each 30 mL vial contains 639 mg. Since the accepted dose for xylocaine is 35 mg/kgbw, the acceptable dose in a 70-kg patient is 2,450 mg = 4 vials

Upper limit at 55 mg/kgbw is 3,850 mg = 6 vials

Since it's evident from the study that majority of surgeons do not change the composition of xylocaine in the infiltration and infiltrate an average of 6-7 L, *is it likely that overdose with xylocaine is more frequent than we think?*

Adrenaline

This is an important component of the solution and reduces the blood loss. The maximum reported upper levels for use have been 10mg. The recommended dose is 0.07 mg/kgbw. It is important to note that plasma levels peak at 5 h post operation and not during the procedure. Surgeons using higher doses of adrenaline have to be cautious during this window period.^[20]

Soda bicarbonate

This was ostensibly added to the infiltrate to neutralize the acidic PH of xylocaine and reduce pain during infiltration. Since the majority of the surgeons perform the procedure under anaesthesia, its use can be questioned. Adding sodium bicarbonate to sensorcaine can result in the immediate precipitation of sensorcaine. Injecting such a suspension intradermally or subcutaneously has caused full thickness dermal necrosis and hence, should be avoided.

Hylase

There is no evidence to support its use.

Triamcinolone

No conclusive evidence: Early reports of benefit were offset by providing adequate drainage.

From the above, it is easy to glean that only adrenaline is essential in the infiltration solution. The rest of the components can safely be discarded with no change in efficacy or pain relief.

Are we justified in adding all the other components and increasing the risk of iatrogenic complications?

Fluid resuscitation

The current evidence is divided over the exact replacement volume.

Most surgeons in the study follow their own protocol and replace fluids using clinical guidelines.

Large volume liposuction patients can present an especially difficult challenge for fluid resuscitation. As previously mentioned by Rohrich *et al.* in 1998 (updated in 2006),^[21,22] the following formula can help in fluid management for these patients.

1. Replace losses from preoperative oral intake loss as needed.
2. Maintain fluid throughout the procedure and manage it based on vital signs and urine output.
3. Employ the superwet infiltration technique.
4. Administer crystalloid replacements, 0.25 mL for each millilitre of lipoaspirate over 5 L.

Careful attention must be paid to all fluids infused (infiltrate/IV fluids) and total output (aspirate/blood loss from other procedures/urine output). Patients with residual fluid volume outside the range of 90-140 mL/kg may require the judicious use of diuretics or IV hydration.^[23] Fluid overload and untoward sequelae from large volume liposuction (more than 5 L) prompted a warning by the ASPS that physicians performing liposuction should be trained in comprehensive fluid resuscitation and the physiology of large volume liposuction.^[24]

Kenkel^[25] in a prospective study showed that young healthy patients with compliant right ventricles could accommodate the fluid loads of large volume liposuction. He advised that patients should be clinically screened for cardiovascular and blood pressure disorders before liposuction is undertaken, and preventative measures should be taken to limit intraoperative hypothermia.

Post operation

Pressure garments

There is no conclusive evidence, which dictates the amount of tightness the garment should provide (coefficient of elasticity). The majority of the surgeons prefer the garment to be snug. Common sense dictates that excessively tight dressing can occlude the lymphatics further and cause an increase in oedema. No study has been conducted to ascertain the role of pressure garments and show a decrease in the results (skin redraping) if they are not used. Recently, using serial magnetic resonance

imaging (MRI) examinations, Swanson^[26] showed that 66% of the swelling after liposuction reduces in 1 month and 87% of the swelling resolves after 3.3 months.

Complications

Liposuction is an inherently safe surgery but one which can lull the unwary into exceeding the margin of safety. Complications can occur in the perioperative period, early postoperative or delayed postoperative periods.

Minor complications

In our survey, 42.1% of the surgeons had contour deformities as the commonest complication, whereas 30.6% felt seromas were more common. This was similar to other reports.^[27-29]

Major complications

The last conducted census survey by ASAPS^[30] in 2000 showed a mortality rate of 19.1/100,000 procedures. Although 81.3% of the surgeons in the current survey believed that our mortality rates must be lesser than the above figure, 63% also accepted that the incidence of serious complications/morbidities must be higher than reported.

The survey stressed on this particular aspect of serious complications (which could have but did not result in death) and the factors responsible.

Hypothermia

Hypothermia occurs commonly in liposuction cases. Its risk is amplified in larger volume cases where more of the patient is exposed at one time. The core body temperature can drop up to 2.8°C in the first hours of surgery. This is due to anaesthesia effects on autonomic regulation of core temperature, as detailed by Young and Watson.^[31] Warming of the wetting solutions and prep, increase of the ambient temperature, and use of warming devices all help to reduce losses during liposuction.^[32,33] In the survey, 46.5% of respondents reported that they warmed the fluid prior to infiltration.

Fluid overload

Fluid management is crucial to the prevention of volume overload and anaesthesia-related complications. As stated previously, careful management of intraoperative and postoperative fluids as well as the use of an intraoperative data sheet helps prevent volume-related complications from liposuction. 92.9% of the respondents reported observing signs suggestive of

fluid overload in <5% of their cases but 77.4% believe that this incidence can increase with a volume of infiltrate beyond 7-8 L.

Similarly, 53.6% of the surgeons felt they could send the patient home the same day after aspirating <5 L but 87.9% felt that they would not send the patient home if the aspirate was more than 7 L. Both these findings show that surgeons were aware of an increased risk to the patient when performing large volume liposuction. The question remains — when does the risk reward ratio get skewed?

Fat embolism syndrome

In the current survey, 30.6% surgeons believe that FES is responsible for majority of complications. It has been repeatedly shown in animal studies^[34-36] that there is a definite systemic mobilization of fat following liposuction. FES has been reported^[37-40] but is difficult to diagnose. It is possible that the majority of these cases remain undiagnosed and hence, the true incidence is underreported.

In cases of large volume liposuction, it is therefore, imperative to be aware of this dreaded complication and to have a high index of suspicion based on the patient's symptoms. Specific criteria and guidelines have been described for diagnosis of FES.^[38]

Other serious (but rare) complications include DVT/pulmonary thromboembolism/necrotising fasciitis/peritoneal perforation/xylocaine toxicity, etc., all of which have been mentioned in the literature.

Twenty seven surgeons out of 118 reported having at least one life-threatening complication after liposuction in the last five years. The current survey encompasses a minimum of 15,600 patients ($96 \times 32.5 \times 5$ (number of surgeons who answered this query \times average number of surgeries per year \times number of years)) to a maximum of approximately 19,200 patients ($118 \times 32.5 \times 5$). This gives a mean of 17,400 patients. Since 27 patients had serious morbidity, the incidence of this occurrence was 1/644 patients, which is a high incidence for a purely cosmetic surgery. Most surveys and reports in the past have evaluated fatalities after liposuction. This facet of serious morbidity (not leading to death) has not been evaluated till now.

The data was analysed for statistical correlation using the chi-square and Fisher's exact tests.

There was no statistical significance found between the frequency of the procedure performed and the occurrence of complications as per Fisher's test (P value = $0.3695 > 0.05$). Similarly, a chi-square test did not show any correlation between seniority of the surgeon and complications. There was a higher incidence of complications after UAL but it was not statistically significant [Table 1].

The only parameter, which achieved statistical significance to the occurrence of complications, was total aspirate.

Across all segments in seniority and frequency of the procedure performed, the complications rates are higher when the average aspirate is >5 L. As per Fisher's exact test (P -value = $0.0115 < 0.05$), there is an association between complications (yes vs no) and total aspirate (<5 L vs ≥ 5 L).

It is interesting to note that of the 27 surgeons who have had complications, the majority are surgeons who are performing less than 70 cases annually. Even more remarkable is to note that 21 of these 27 surgeons continue to feel that liposuction is a safe procedure. In those aspirating between 5 L and 10 L, 3/10 surgeons who had complications were performing <10 /year. 4/16 who had complications performed between 10 cases and 30 cases, and 11/25 were in those doing between 30 cases and 70 cases per year [Table 2].

It was probably important to assess if these complications happened in conjunction with an additional procedure or just with liposuction. In our country, the commonest procedure performed in association with liposuction is abdominoplasty. It was also significant to ascertain if any of these also had any comorbid conditions.

Furthermore, when asked if they had treated their own or someone else's (serious) complications 47/118 surgeons had treated a patient at least once. 6/118 had treated patients with complications two to five times. On a conservative estimate, this would approximately comprise 60 patients with complications. The incidence of complications then rises to 1/290 patients.

This may be due to a number of factors.

1. A combination large volume liposuction with abdominoplasty/other excisional surgery.
2. Poor selection of patients.
3. Fluid overload with potential haemodynamic compromise.
4. Operation in small clinics and outpatient facilities with improper monitoring.
5. Surgery by untrained/non-plastic surgeons.
6. A mistaken notion that liposuction cannot cause major complications.

It may be possible that this high incidence represents the early phase (learning curve) of the procedure, and

Table 1: Correlation of technique used, complications and average aspirate

Technique of liposuction	Have you had a serious/life-threatening complication after ...	Always <5 L	Majority between 5 L and 10 L	Majority >10 L
SAL [†]	Yes	1	11	0
	No	2	25	0
PAL [‡]	Yes	2	5	1
	No	2	12	3
Ultrasound/Vaser-assisted	Yes	0	7	0
	No	0	2	0

[†]SAL: Suction-assisted liposuction; [‡]PAL: Power-assisted liposuction

Table 2: Correlation between complications, average number of cases per year and average aspirate

Have you had a serious/life-threatening complication after ...	Average number of liposuction ...	Always <5 L	Majority between 5 L and 10 L	Majority >10 L
No	<10	6	7	0
	10-30	10	12	2
	30-70	4	14	0
	>70	1	3	1
Yes	<10	1	3	0
	10-30	2	4	0
	30-70	0	11	1
	>70	0	3	0

with time and experience, this number will substantially reduce. This parallels an alarming rate of complications, which happened in the United States of America in the late nineties, which prompted the ASPS to give a warning to its members.^[24] Subsequently, a census survey^[41] showed a decrease in mortality rate.

Would it be prudent if we establish guidelines and recommendations for the procedure in the Indian scenario to curtail this high incidence of complications and make the procedure safer for all our patients?

Limitations of the survey

- The data size was small.

However, the survey had responses from most of the leading aesthetic surgeons in our country and hence, can be considered as well-represented.

- The response rate could have been better.

The survey was emailed to all surgeons from the APSI database. In addition, reminders were posted on yahoo groups and separate emails were sent to all surgeons who had personal websites.

Despite all of this, the survey completion rate was <10%.

- The design of the survey

It would have been prudent to ask about comorbidities in patients who had complications.

Similarly, it would have been useful to know if there was an association between the complications and additional procedures.

Also, some surgeons felt that the survey could have been more exhaustive.

CONCLUSION

This is the first ever survey about liposuction conducted in India. Although, the response ratio was less, it shows a vast difference in the way the procedure is performed in India. It also makes us alert about a startling high number of morbidity/mortality after liposuction. Most of the responses to the questions open up avenues for additional thoughts. The need of the hour is a set of cohesive, well-knit guidelines for performing liposuction for Indian plastic surgeons.

Image 2: Salient findings of the survey

- Liposuction is the commonest aesthetic procedure performed by Indian plastic surgeons. The average number done is 32.5/year.
- Patient selection subtly changes with increasing familiarity. More experienced surgeons rarely operate on patients with BMI >30.
- The majority of surgeons (64.7%) performed suction-assisted liposuction (SAL).
- The majority of surgeons (70.3%) aspirated >5 L at one time.
- The majority (80.2%) felt that the limits for liposuction should be relative and not absolute.
- The commonest procedure performed in conjunction with liposuction is abdominoplasty (90.7%).
- The majority (69.1%) also felt that adding a procedure increases the incidence of complications.
- The survey highlights lack of standardization with respect to infiltration solutions.
- 80% of respondents did not change the composition of the infiltration solution when infiltrating >5 L.
- 77.4% agreed that the incidence of complications would increase when the aspirate was >7 l.
- The commonest complication observed were contour irregularities, followed by seroma and inadequate skin redrape.
- Although the majority (81.3%) believed that our mortality rates must be lesser than 19/100,000, 63% also believed that the incidence of serious complications was much higher than reported.
- 27.8% surgeons reported having at least one life-threatening complication after liposuction.
- The numbers of responses for complications increased from 27.8% to 67.9% when asked if the respondents had managed someone else's complications (Figure 36).
- Across all segments, the complications rates were higher when the average aspirate was >5 L. The amount of aspirate is the only factor, which achieves statistical significance with respect to complications. As per Fisher's exact test (P value = 0.0115 < 0.05) there is an association between complication (yes vs no) and total aspirate (<5 L vs ≥5L).
- There was no statistical significance found between the seniority of surgeon/frequency of procedure/type of liposuction performed and occurrence of complications as per Fisher's test.
- The incidence of serious morbidity varies between 1/644 (own) patients and 1/290 (other) patients.

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