Cross-sectional Study

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# Lipectomy for madelung disease using tumescent technique: a cross-sectional study

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**Background:** Madelung's disease is a rare disfiguring disorder that affects both function and esthetic appearance in the head and/or shoulder, neck, and arms regions. Lipectomy is typically necessary but such treatment can encounter difficulties due to the large sizes of the tumors, interspersed with important organs in the surrounding region. In this report, the authors evaluate the effectiveness of using tumescent solution in lipectomy to provide a dual treatment of tissue removal for Madelung disease in the head-and-neck region.

**Methods:** A prospective study and clinical descriptions were conducted on 17 patients undergoing 26 head-and-neck lipectomies. A tumescent solution was injected into the surgical region with a blunt-tip cannula 5–10 min before skin incision. The authors recorded systemic manifestations both during and after surgery; tumescent volume; surgical region; clarity of the operative field; weight of fat removed, and early complications. After surgery, the authors followed the patients from periods of 3 months to 4 years.

**Results:** All 17 male patients had a history of alcoholism. In total, 12 lipectomies for the removal of anterior neck fatty masses and 14 lipectomies for the removal of posterior neck fatty masses were performed. The average amount of tumescent injected was 260.1 ml (range 140–550 ml). Surgery was reported as totally bloodless in 10 (38.5%) operative fields, with minimum bleeding in 12 (46.1%) operative fields, acceptable bleeding in four (15.4%) operative fields. The average surgical time was 175.6 min (range 135–250 min). The removed fatty masses weighed between 250 and 2150 g, with an average of 582.9 g. Early complications were seen in four patients, accounting for 15.4% (2 hematoma, 1 skin necrosis, and 1 seroma).

**Conclusions:** Using tumescent solution in lipectomies to treat Madelung disease in the head and neck area is a simple, safe, and useful technique. The technique helps to create a clean operative field, reduces bleeding, and thereby assists surgeons during the operation.

**Keywords:** lipectomy, madelung, operative field, tumescent

## Introduction

Madelung disease was first described by Sir Benjamin Brodie in Lectures Illustrative of Various Subjects *in Pathology and Surgery* in 1846, followed by Madelung in 1888 and Launois in 1898. The disease is also known as Launois Bensause syndrome or multiple symmetric lipomatosis (MSL), and is characterized by the appearance of adipose tissue in the subcutaneous layer of different regions of the body[1]. Fatty masses can appear in all regions of the body along with systemic diseases.

Of the regions where fatty masses appear, the head and neck are the most exposed region. Large masses will cause severe deformation in this region that affects both esthetic and bodily function, so it is the region of the body that needs treatment the most.

Surgical intervention is the most reasonable option to reduce the size of fatty masses in the neck region, and includes two types: lipectomy and liposuction. Liposuction has the advantages of being less invasive, leaving minimal scarring, a shorter recovery

### HIGHLIGHTS

- Madelung's disease is a rare disfiguring disorder that affects both function and esthetic appearance in the head and/or shoulder, neck, and arms regions.
- Lipectomy is typically necessary but such treatment can encounter difficulties due to the large sizes of the tumors, interspersed with important organs in the surrounding region.
- Using tumescent solution in lipectomy to treat Madelung disease in the head and neck area helps to create a clean operative field, reduces bleeding, and assists surgeons during the operation.

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**Figure 1.** Patients with Madelung (front view).

time, a smaller risk/rate of vascular or nerve damage, and fewer postoperative complications such as hematoma or skin necrosis. However, the procedure is difficult to implement in cases of large fat masses, particularly in the nape area, where the organization of fibrous fat is firmest.

Lipectomy could remove more fatty masses than liposuction, but it is not easily implemented due to the infiltrative nature of the fatty masses at multiple areas, and involvement with other anatomical structures, meaning it is rarely possible to remove all of them[2–4].

The size of the fatty masses are large, demanding a large surgical area; meanwhile, the fat is located near the large blood vessels, the trachea, the esophagus, the submandibular gland, etc., so the surgery takes much more time with an attendant higher risk of complications. A large fatty mass might take many surgeries to safely remove it all. If a clean operative field *can* be created, this will make surgery faster, more convenient, and thorough, while avoiding damaging important structures in the neck.

Tumscent solution was first reported by Klein in 1987. Consisting of 0.9% NaCL components; lidocaine; epinephrine, and sodium bicarbonate, the solution was first used in liposuction. Many authors have used different tumescent formulations, with variable composition and drug ratios. The advantage of this solution is vasoconstriction, which reduces bleeding and prolongs the analgesic effect; previous studies mainly used tumescent solution as an anesthesia or analgesia support.

Several recent reports have emphasized the use of this solution to create a blood-free operative field to ease surgery[5,6]. Tumescent has also been effectively used in breast-reduction surgery, limb surgery, thyroidectomy, cosmetic surgery, and other procedures.

In the previous report, we presented the surgical procedure of MSL for the removal of the fat lobes of the anterior and posterior neck[7]. This report focuses on the experience of using tumescent solution during MLS surgery with an aim to create an operative field with less bleeding, reduced operating time, and limited nerve and blood vessel damage at our hospital.

## Methods

We reviewed the medical records of 17 patients with MSL of the head and neck, with 26 fat-removal surgeries performed between May 2018 and October 2022.

We collected data on personal information, lesion location, associated pathology, anesthesia method, surgical method, the

**Figure 2.** Patients with Madelung (rear view).

volume of tumescent solution injected, evolution in the process of anesthesia, clarity of the operative field, operative time, volume of fat removed, and early complications.

Patients with a history of hypertension were treated to stabilize blood pressure before surgery (systolic blood pressure <140 mmHg) and took blood pressure medication in the morning

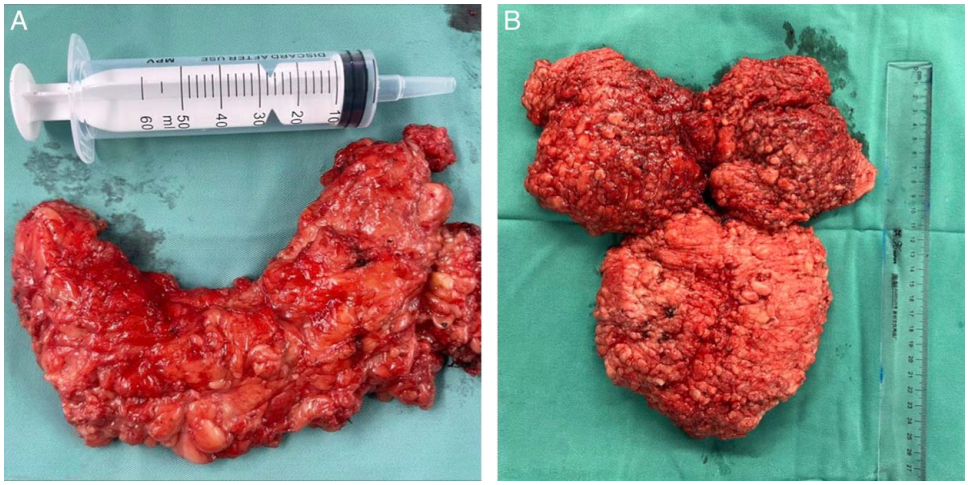


**Figure 3.** Fat tissue postremoval. A: Anterior, B: Posterior.

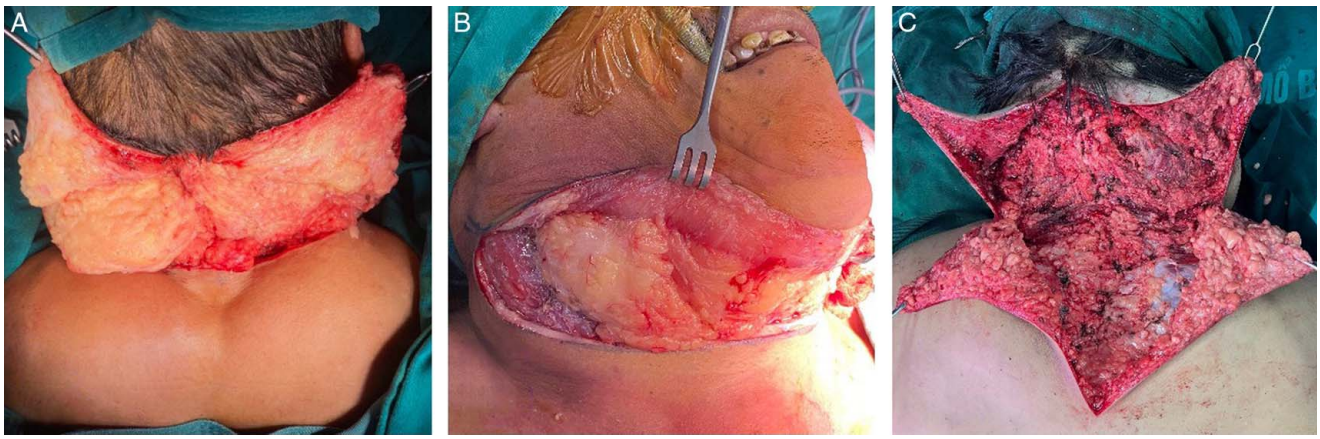


**Figure 4.** Clarity of operative field. A: Totally bloodless. B: Minimum bleeding. C: Acceptable bleeding.

both before and after surgery. The surgery was performed in the same procedure following the main steps as follows[7]:

We divided the surgical treatment into two stages: excision of the anterior neck tumor (Fig. 1) and resection of the posterior neck tumor (Fig. 2), with a period of 6 months between each stage. The two stages were performed in the order preferred by the patient. The anterior cervical region consists of fat lobes 1–4, the posterior cervical region consists of lobes 5 and 6[7].

All patients received general anesthesia with endotracheal intubation. The anesthesiologist was informed that tumescent solution, containing lidocaine and epinephrine, would be injected. Intraoperative heart rate and blood pressure were recorded intraoperative and 24 h postoperative.

About 5–10 min before skin incision, we used Knife 11 to make small circular incisions about 2 mm into the surface of the skin, then injected Tumescent solution (i.e., 1000 ml Ringer's lactate, plus 1mg epinephrine and 250 mg 2% lidocaine) into the surgical area using a blunt-tip cannula (2 mm diameter) for liposuction. The solution was injected until the surgical area became tense and blanched, then the injected fluid was refluxed out from the source of injection, and subsequently halted.

When operating on the anterior neck region, we made an incision in a transverse line in the anterior neck wrinkles. In the posterior neck area, the incision was made in a cross or inverted T-shape. A lipectomy was performed by two surgical teams simultaneously on both sides to reduce surgery time. The surgical process was performed according to the principle of dissection above the surface, under the skin's muscle layer. The fat tissue was neatly cut into a block. If the fat was considered too massy, it was divided according to the fibrous septa between the lobes (Fig. 3). Fat was then removed and bleeding carefully stopped, then the skin flap was sewn to the bottom layer to avoid creating an empty space using absorbable suture (3–0 Vicryl). We placed a negative-pressure surgical drain with a diameter of over 4 mm

**Table 1**

**Patients' characteristics based.**

| Case | Age (years) | Sex | Schiltz's classification | Times of alcoholism (Y) | Comorbid diseases |
|---|---|---|---|---|---|
| 1 | 57 | M | Ic | 32 | HS; |
| 2 | 51 | M | Ic | 30 | HS; EHE; DM; Hypertension; Depression |
| 3 | 38 | M | III | 25 | Hypertension |
| 4 | 54 | M | Ib | 33 | HS; EHE; Hypertension |
| 5 | 45 | M | Ib | 19 | EHE; |
| 6 | 54 | M | Ic | 35 | |
| 7 | 59 | M | Ic | 20 | EHE; Hypertension |
| 8 | 68 | M | Ic | 48 | EHE; Thrombocytopenia |
| 9 | 52 | M | Ib | 27 | OSA; HS; EHE |
| 10 | 62 | M | Ic | 32 | OSA; Hypertension; DM |
| 11 | 60 | M | III | 40 | EHE; Hypertension |
| 12 | 56 | M | Ib | 31 | HS; EHE |
| 13 | 46 | M | Ib | 26 | EHE; Thrombocytopenia |
| 14 | 48 | M | Ib | 28 | EHE; Macrocytosis |
| 15 | 68 | M | Ic | 48 | |
| 16 | 56 | M | Ia | 36 | HS; EHE; Macrocytosis |
| 17 | 63 | M | Ic | 43 | OSA; HS; EHE; DM; Hypertension |

DM, Diabetes mellitus; EHE, Elevated hepatic enzymes; HS, Hepatic steatosis; OSA, Obstructive sleep apnea.

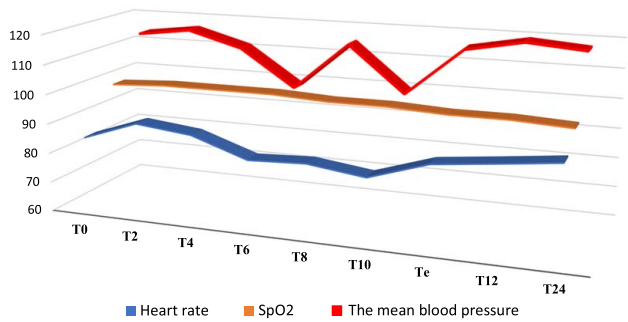


**Chart 1.** The mean blood pressure, heart rate, and oxygen saturation were recorded during the tumescent procedure and surgery. $T_{0:}$ prior to Tumescent injection, $T_2$: 2 min after injection, $T_4$: 4 min after injection $T_6$: 6 min after injection, $T_8$: 8 min after injection, $T_{10}$: 10 min after injection $T_{e:}$ end of surgery, $T_{12}$: 12 h after surgery, $T_{24}$: 24 h after surgery.

**TABLE 2**

**Patients' characteristics based on surgical procedures by location.**

| | Anterior neck Lipectomy $N=12$ (100%) | Posterior neck lipectomy $N=14$ (100%) | Total $N=26$ (100%) |
|---|---|---|---|
| Age (y) | | | |
| Range | | | 38–68 |
| Mean | | | 55.1 |
| Times of Alcoholism (Y) | | | |
| Range | | | 19–48 |
| Mean | | | 32.5 |
| Comorbid diseases | | | **15 (88.2**) |
| HS | | | 7 (41.2) |
| EHE | | | 11 (64.7) |
| DM | | | 3 (17.6) |
| Hypertension | | | 7 (41.2) |
| Depression | | | 1 (5.9) |
| OSA | | | 3 (17.6) |
| Macrocytosis | | | 2 (11.8) |
| Thrombocytopenia | | | (11.8) |
| Clarity of operative field | | | |
| Totally bloodless | 7 (58.3) | 3 (21.4) | **10 (38.5)** |
| Minimum bleeding | 4 (33.3) | 8 (57.1) | **12 (46.1)** |
| Acceptable bleeding | 1 (11.1) | 3 (21.4) | **4 (15.4)** |
| Volume of Tumescent (ml) | | | |
| Range | 140–300 | 220–550 | 140–550 |
| Mean | 195.8 | 315.7 | 260.4 |
| Length of surgery (min) | | | |
| Range | 135–190 | 170–250 | 135–250 |
| Mean | 159.6 | 189.3 | 175.6 |
| Weight of fat removed (g) | | | |
| Range | 250–740 | 440–2.150 | 250–2.150 |
| Mean | 363.75 | 770.7 | 582.9 |
| Local early complication | | | **4 (15.4)** |
| Hematoma | 1 (8.3) | 1 (7.1) | 2 (7.7) |
| Skin necrosis | | 1 (7.1) | 1 (3.8) |
| Seroma | | 1 (7.1) | 1 (3.8) |

The bold values is number of patients and percentage respectively.
DM, Diabetes mellitus; EHE, Elevated hepatic enzymes; HS, Hepatic steatosis; OSA, Obstructive sleep apnea.

and sutured the skin. The drain was removed when the volume of the accumulated fluid was less than 30 ml in 24 h. We removed the patient's sutures approximately 10–14 days after surgery.

The clarity of the operative field was subjectively evaluated by dividing the field into the following three categories[8,9]: totally bloodless; minimum bleeding; and acceptable bleeding. The totally bloodless category involves a bloodless-operative field condition that is similar to that achieved by using a pneumatic tourniquet. Minimum bleeding is defined as bleeding in the operative field that does not hinder the recognition of anatomical structures, and does not need frequent use of gauze to absorb blood. Acceptable bleeding represents a condition that needs more frequent blood absorption in order to preserve anatomical recognition, while not hampering the performance of complicated surgical procedures (Fig. 4).

This study has been reported in line with the strengthening the reporting of cohort, cross-sectional and case-control studies in surgery (STROCSS) criteria[10].

**TABLE 3**

**Changes in systolic blood pressure during and after surgery.**

| Time | Min | Max | X ± SD |
|---|---|---|---|
| $T_0$ (prior to Tumescent injection) | 95 | 138 | 113.7 ± 7.82 |
| $T_2$ (2 min after injection) | 98 | 142 | 116.1 ± 6.01 |
| $T_4$ (4 min after injection) | 84 | 130 | 110.9 ± 8.54 |
| $T_6$ (6 min after injection) | 80 | 124 | 98.2 ± 9.23 |
| $T_8$ (8 min after injection) | 82 | 133 | 114.6 ± 8.08 |
| $T_{10}$ (10 min after injection) | 80 | 120 | 99.1 ± 9.11 |
| $T_E$ (end of surgery) | 96 | 136 | 115.3 ± 7.02 |
| $T_{12}$ (12 h after surgery) | 105 | 136 | 118.9 ± 4.98 |
| $T_{24}$ (24 h after surgery) | 98 | 138 | 117.3 ± 4.99 |

## Results

Seventeen male patients participated in this research with 26 surgeries. The age ranges from 38–68 years old, with the average age 55.1 years old. Demographic data of patients, Schiltz's classification of MSL, histories of alcoholism, and other comorbidities are shown in Table 1.

All patients received general anesthesia with endotracheal intubation; none of them required a tracheostomy. The anesthetic process did not have any special developments. Immediately after the injection of Tumescent solution, the patient's heart rate and blood pressure increased but insignificantly (change in heart rate and blood pressure were at < 20% of baseline). Indicators of heart rate, oxygen pressure, and systolic blood pressure at recorded times are shown in Chart 1 and Table 2.

The surgical site, time of surgery, volume of tumescent injected, volume of fat removed, and early complications are shown in Table 3. All patients were applied with a tumescent solution during surgery. The average amount of tumescent injected was 260.1 ml (ranged from 140–550 ml). The technique produced totally bloodless results in 10 (38.5%) operative fields, minimum bleeding in 12 (46.1%) operative fields, and acceptable bleeding in four (15.4%) operative fields (Fig. 3). No operative field was classified as a bleeding category.

None of the patients required a blood transfusion either during or after surgery. The surgical time lasted from 135–250 min (175.6 min on average). The removed fatty masses weighed between 250 and 2150 g, with an average of 582.9 g. Four patients, accounting for 15.4%, had early complications, including two hematomas, one skin necrosis, and one seroma.

We followed the patients for a period of three months to four years postoperatively. Sixteen out of 17 patients were satisfied with the esthetic and functional improvements resulting from their surgery. Only one patient continued to drink alcohol and developed a recurrence of fatty neck masses four months after surgery.

## Discussion

Tumescent solution was first used in liposuction on 5 April 1985, by Dr Klein, with the effect of anesthesia and reduction of blood loss[5,6,8,9]. The solution is now increasingly used in many types of surgery in many different parts of the body, such as whole-body liposuction, breast-reduction or mastectomy due to pathology, surgery due to trauma, or burns. In neck surgery, Tumescent has been used in liposuction, thyroidectomy, or neck dissection.

The fatty neck mass in MSL patients is characterized by its large size, located under the muscle layer attached to the skin and

**TABLE 4**

**Patients' characteristics based on operative field and complication.**

| Case ($N=17$) | Operative field ($N=26$) | Volume of Tumescent (ml) | Clarity of operative field | Length of surgery (min) | Weight of fat removed (g) | Local early complication |
|---|---|---|---|---|---|---|
| 1 | Posterior neck | 550 | Acceptable bleeding | 250 | 2.150 | Skin necrosis |
| | Anterior neck | 220 | Totally bloodless | 190 | 420 | |
| 2 | Anterior neck | 180 | Totally bloodless | 155 | 280 | |
| | Posterior neck | 240 | Acceptable bleeding | 160 | 440 | |
| 3 | Posterior neck | 460 | Minimum bleeding | 210 | 1.530 | Hematoma |
| | Anterior neck | 220 | Totally bloodless | 155 | 350 | |
| 4 | Posterior neck | 380 | Minimum bleeding | 175 | 610 | |
| | Anterior neck | 200 | Minimum bleeding | 140 | 250 | |
| 5 | Posterior neck | 310 | Minimum bleeding | 170 | 585 | |
| | Anterior neck | 160 | Acceptable bleeding | 140 | 280 | |
| 6 | Posterior neck | 370 | Minimum bleeding | 205 | 1.150 | |
| | Anterior neck | 140 | Minimum bleeding | 165 | 300 | |
| 7 | Posterior neck | 270 | Minimum bleeding | 185 | 700 | |
| | Anterior neck | 140 | Totally bloodless | 135 | 270 | |
| 8 | Anterior neck | 280 | Minimum bleeding | 160 | 420 | |
| | Posterior neck | 260 | Totally bloodless | 180 | 460 | |
| 9 | Posterior neck | 240 | Minimum bleeding | 190 | 545 | |
| | Anterior neck | 190 | Totally bloodless | 175 | 335 | |
| 10 | Anterior neck | 300 | Totally bloodless | 190 | 740 | Hematoma |
| 11 | Posterior neck | 340 | Totally bloodless | 205 | 610 | Seroma |
| 12 | Posterior neck | 220 | Minimum bleeding | 170 | 470 | |
| 13 | Posterior neck | 300 | Minimum bleeding | 175 | 515 | |
| 14 | Posterior neck | 230 | Acceptable bleeding | 190 | 490 | |
| 15 | Posterior neck | 250 | Totally bloodless | 185 | 535 | |
| 16 | Anterior neck | 170 | Totally bloodless | 150 | 350 | |
| 17 | Anterior neck | 150 | Minimum bleeding | 160 | 370 | |

among the anatomical structures of the neck [2,7,11]. Lipectomy carries the risks of bleeding, blood vessel damage, a wide operative field, prolonged operative time, and systemic complications. The creation of a clean operative field will assist surgery to be performed quickly and smoothly, thereby reducing complications. To our knowledge, tumescent solution has been used in liposuction for the treatment of MSL, however, there are no reports stating its value in lipectomy[3,4].

In some surgeries, such as trauma, mastectomy, or breast augmentation, Tumescent can be used alone to anesthetize; however, in MSL patients, the large fatty masses and the pressure of Tumescent injection can cause tracheal compression, requiring general anesthesia. All patients included in the report received general anesthesia with controlled respiration. After Tumescent was injected, tachycardia and higher blood pressure appeared but were not serious, and required no treatment. The safety of using Tumescent has been proven in many studies[5,12,13,14]. We found no systemic side effects when using this technique both during and immediately after surgery (Fig. 1). Immediately after Tumescent injection, there were cases of increased pulse and blood pressure; however, they were all below 20% of the initial value, and required no treatments. There were six patients with a slight increase in blood pressure after the first 12 h postsurgery. After being treated with Nefopam (20 mg) and Paracetamol (1 g) intravenously, their blood pressure returned to normal.

After injection, tumescent helps reduce bleeding and creates a clear operative field. The effect of reducing blood loss originates from two mechanisms: vasoconstriction, due to the effect of epinephrine, and the mechanical effect of the injected volume, causing tissue swelling and leading to compression of small blood vessels[11]. In this report, the average volume of tumescent injected into the operative field was 260.2 ml; the amount of fluid varied from 140 to 550 ml; and the mean volume injected into the same anterior and posterior neck area was 195.8 ml and 315.7 ml, respectively (Table 4), but this data is insignificant. Many authors reckon that there is no formula to calculate the amount of Tumescent solution required for injection. The volume of fluid depends on the extent and size of the operative field as well as the type of surgery[8,12]. We stopped injecting tumescent into the operative field when there were local signs such as the surgical area becoming tense and blanched, or the injected fluid regurgitating at the point of injection.

The technique of injecting fluid in the anterior and posterior neck region varies. The anterior neck region involves many anatomical structures, such as the carotid artery, trachea, and esophagus, so care should be taken to avoid injuries. However, the fatty masses in the anterior neck region are usually loose and soft, so the fluid can be injected in two areas: the superficial layer under the muscle, attaching to the skin of the neck, and the deeper layer when such a muscle is lifted up by hand. The posterior neck region is a pressure area, so the fatty masses are quite dense. No important structures are situated in this area, so it is possible to inject Tumescent into the subcutaneous layer and also between the fat tissue without any risk of complications.

Blunt-tip cannulas are used to inject tumescent solution, thus minimizing the complication of needle penetration into the blood vessel. When using Tumescent in trauma, author Prasetyono encountered two cases of necrosis of the entire skin flap. He assumed the cause was that the tumescent needle punctured the


**Figure 5.** Preoperative and postoperative images of anterior neck lipectomy. A-B: Preoperative. C-D: Postoperative.

perforator and that he had used a sharp needle to inject fluid into the operative field[8].

Tumescent injection creates 26 clear operative fields. In anterior neck fat-removal surgery, the cleanliness, classified into totally bloodless; minimum bleeding; and acceptable bleeding categories were seven operative fields (58.3%), four operative fields (33.3%), and one operative field (11.1%), respectively.

In posterior neck fat-removal surgery, cleanliness classified into three categories were three operative fields (21.4%), eight operative fields (57.1%), and three operative fields (21.4%), respectively. However, the differences in cleanliness of the operative field between the two regions were not statistically significant. A clean surgical field helps surgeons operate faster, and reduces blood loss – at no point did any patients need a blood transfusion either during or after surgery.

Pinto's study showed that, to thoroughly remove the fatty masses, each patient's anterior neck area needed, on average, two separate surgeries (35 patients; 62 procedures). The posterior cervical region can be operated on more radically (54 patients; 66 procedures)[2]. In this study, no surgical areas needed more than a single surgery to remove most of the fatty masses: 16 out of 17 patients were satisfied and had no need for additional surgery (Figs. 5,6); while one out of the 17 patients continued to abuse alcohol after surgery and thus developed a recurrence of fatty mass.

Early postoperative complications we encountered in four of the surgeries accounted for a total of 15.4% (including two hematoma, one seroma, and one skin necrosis); posterior neck surgery neck encountered three early complications, or 21.4%; while an anterior neck surgery had one early complication (8.3%). These complications are generally common in the surgical treatment of MSL around the head and neck region[2], but we did not encounter any systemic complications.

Some authors have also mentioned complications, and systemic complications encountered during surgery to treat MSL, such as respiratory failure requiring tracheostomy, and large blood loss requiring a blood transfusion[15]. Patients with MSL often have comorbidities in the liver (mostly due to the aforementioned chronic alcohol abuse), as well as coagulation and other factors, which can easily aggravate systemic complications[2,16]. We found that using Tumescent solution; however, made the operative field cleaner, reduced bleeding, shortened surgery times, and reduced the risk of systemic complications.

The disadvantage of this study is that any assessment of the cleanliness of the operative field is still subjective, and there is no


**Figure 6.** Preoperative and postoperative images of posterior neck lipectomy. A-B: Preoperative. C-D: Postoperative.

current way to assess the amount of blood loss during surgery with a high degree of accuracy.

## Conclusion

We conclude that the tumescent solution in lipectomy is able to create a clean operative field, reduce bleeding, shorten surgery time, and thus decrease the risk of complications during and after surgery. Applying this technique in the surgical treatment of MSL in the head and neck region is therefore simple, useful, safe, and worthy of considerations by surgeons.

## Ethical approval

Ethical approval was obtained from institutional review board of local faculty and the participating hospital.

## Consent

None.

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## Author contribution

N.Q.D.: study concept, data collection, data analysis and writing the paper; L.D.L.: study concept, data collection, data analysis and writing the paper; N.T.T.: study concept and writing the paper; H.N.H.: study concept, data collection, data analysis and writing the paper; N.P.T.: study concept and writing the paper.

## Conflicts of interest disclosure

All authors declare no conflicts of interest.

## Research registration unique identification number (UIN)

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## Provenance and peer review

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