

## Death after liposuction: case report and review of the literature

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### Abstract

We report the case of a 41-year-old woman who died after surgical intervention for liposuction. The case was studied by a methodological approach including examination of clinical records and documentation, analysis of anatomo-histopathological findings and evaluation of physicians' behaviour. Autopsy excluded the lethal complications most frequently associated with liposuction (pulmonary embolism, sepsis, necrotizing fasciitis, perforation of abdominal organs) and identified the cause of death as 'massive necrosis of brain-stem and cerebellum, due to spontaneous thrombosis of the basilar and cerebellar district'. Analysis of the physicians' behaviour, together with a review of the literature, excluded medical errors or malpractice. The Court of Law ruled the death as a fatal unforeseeable complication of the operation. The medico-legal interest of the case lies in the singular anatomo-pathological cause of death, discussed in relation to the hypothesis of professional responsibility after surgical intervention for liposuction.

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Liposuction, currently the second most commonly performed aesthetic operation in the United States,<sup>1</sup> is a surgical technique which improves the body's contour by removing excess fat from deposits located between the skin and the muscle.<sup>2</sup> Minor and major complications after surgery have frequently been described;<sup>3–7</sup> in some cases, disastrous complications have been related to lack of expertise and experience on the part of the physician.<sup>8</sup> The case reported here is of medico-legal interest, which lies in the singular anatomo-pathological cause of death, discussed in relation to the hypothesis of professional responsibility after liposuction.

### Case report

#### Clinical documentation

On 29 March, a 41-year-old woman was hospitalized for surgical treatment of hip and thigh lipodystrophy. Clinical history was negative for smoking, obesity, hypertension, and cardiac and vascular disease; coagulation parameters fell within the physiological range (international normalized ratio 1.00 [0.85–1.20], activated partial thromboplastin time 27 s [25–36], platelets 247,000/mL [130,000–400,000], fibrinogen 291 mg/dL [150–450]) at pre-anaesthesiological assessment; oral contraceptive (drospirenone and ethinyl oestradiol) had been stopped three months previously.

The intervention, performed by the suction-assisted liposuction technique under general anaesthesia (propofol, atracurium besylate and fentanyl citrate) lasted 40 minutes (09:30–10:10 h) and involved the aspiration of a small amount of fat (260 cm<sup>3</sup>) via four points of subcutaneous

access in the trochanteric and lumbosacral regions. No intraoperative complications were reported. High-compression elastic garments were applied for antithrombotic prophylaxis. Some hours post-intervention (14:45 h), nystagmus, mild respiratory depression and bilateral lung crepitations were noted; no alteration of consciousness was recorded, vital signs were relatively stable (blood pressure 120/70 mmHg, arterial oxygen saturation SatO<sub>2</sub> 100%, borderline heart rate 96 bpm). Betamethasone, aminophylline analeptics and furosemide were administered. Thoracic magnetic resonance angiography (MRA) showed regular conformation of arterial and venous pulmonary vessels, and signs of blood stagnation at the level of the inferior pulmonary lobes; a brain computed tomography (CT) scan was negative (16:45 h). Worsening of the patient's medical condition (drowsiness, nystagmus, severe headache and, lastly, progressive impairment of consciousness up to coma [GCS = 5]) was noted over the next few hours (30 March, 01:30 h). Another MRA was performed, highlighting a large hypodense cerebellar area associated with brainstem ischaemic lesion, hydrocephalus and cerebral oedema (05:00 h). The patient was then transferred to the operating room for external ventricular derivation placement (05:40 h). The next MRA showed diffuse ischaemic swelling of the cerebellar hemispheres and of the vermis, ascending transtentorial herniation, cerebellar herniation, compression of the lower brainstem and an abrupt stop of flow within the vertebrobasilar district, probably due to basilar thrombosis (07:30 h). After confirmation of basilar thrombosis by cerebral angiography, mechanical thrombolysis was performed, with recanalization of the vertebrobasilar district (09:30 h). Another CT scan revealed bilateral cerebellar

and temporomesial haemorrhagic infarction, and a large hypodense area involving structures of the posterior cranial fossa and diencephalic structures (11:00 h). Cerebellar and brainstem ischaemic lesions ruled out surgical decompression. After assessment of complete and irreversible cessation of all brain functions, the patient was declared dead (31 March, 13:35 h).

### Autopsy findings

Cerebral oedema (weight of brain 1260 g) and bilateral occipital subarachnoid haemorrhage were evident; massive thrombosis of the posterior inferior cerebellar artery (PICA), left anterior inferior cerebellar artery (AICA), initial part of the right AICA and the spinal artery was found (Figure 1); vertebral and basilar arteries were unaffected. Thrombosis of AICA and PICA was confirmed by histological examination. The left inferior and middle cerebellar peduncles and infero-medial part of the cerebellar vermis were characterized by diffuse cerebellar parenchymal haemorrhage. Parenchymal haemorrhage was also evident in the left cerebellar hemisphere, with initial involvement of the right hemisphere. Sectioning revealed massive necrosis of the cerebellar parenchyma, with a haemorrhagic area in the reticular substance of the bridge, involving the midbrain. No other significant pathological alterations, including heart damage, were determined. In particular, the foramen ovale was closed.

Extemporaneous microscopic examination of the lungs and cerebral parenchyma, previously prepared with Oil Red staining, excluded the presence of fatty particles. Histological findings showed a large area of coagulative necrosis in the midbrain and extensive aspects of haemorrhagic dissociation (Figure 2). No pre-existing abnormalities of the cerebral vessels were evident.

### Cause of death

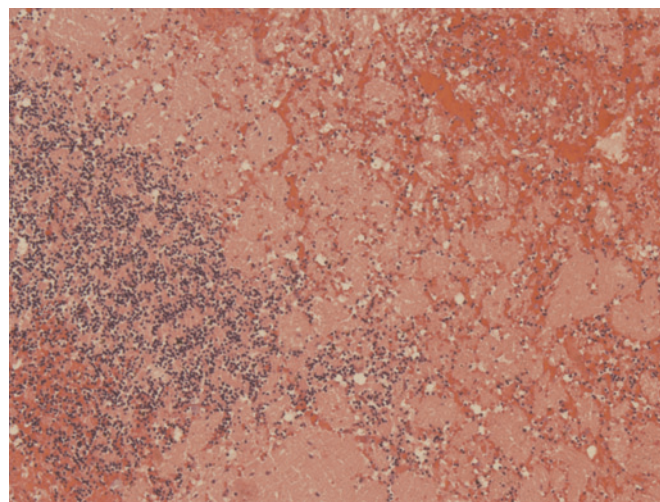
The cause of death was identified as 'massive necrosis of the brainstem and cerebellum, due to primary thrombosis of the basilar artery, with involvement of AICA, PICA and spinal artery'.

### Discussion

Liposuction procedures are widely performed by board-certified plastic surgeons and by non-plastic surgeon



**Figure 1** Centre: massive thrombosis of posterior inferior cerebellar artery (PICA) (in colour online)



**Figure 2** Coagulative necrosis and extensive aspects of haemorrhagic dissociation in left cerebellar hemisphere (in colour online)

physicians.<sup>9</sup> The best results in the surgical procedure are achieved by accurate patient selection. Moderate localized fat deposits in a normal-weight patient with discrete physical shape, and with smooth, tight skin can be treated efficaciously by means of liposuction.<sup>10</sup> The operation is performed under general or local anaesthesia, according to the extent, limited or relevant, of the area to be treated.<sup>11</sup> Intervention may be performed by means of various surgical techniques: wetting solution techniques, standard liposuction or suction-assisted lipoplasty, internal ultrasound-assisted liposuction, Vasser-assisted liposuction, external ultrasound-assisted liposuction (eUAL), laser-assisted liposuction, power-assisted liposuction and vibro-liposuction.<sup>12</sup>

According to some authors,<sup>8</sup> the overall complication rate ranges from 0% to 10% and is associated with the amount of fat removed. Reported fatal complications are significantly related to the combination of liposuction with other surgical procedures (including abdominoplasty);<sup>13</sup> liposuction alone has been fatal in very few cases.<sup>8</sup> In a survey conducted by the American Society for Aesthetic Plastic Surgery,<sup>14</sup> the non-fatal major complication rate per 100,000 liposuctions performed by specialists in plastic surgery was 0.25%; the mortality rate was 0.002%. In recent published studies, the mortality rate was 0.01% and was mainly caused by pulmonary embolism.<sup>15</sup>

Reported minor complications consist of seroma (clear serous fluid collection), irregularity, haematoma, hyperpigmentation, and penile or vulvar swelling.<sup>3</sup>

The most serious complications, avoidable according to some authors<sup>3</sup> by following a strict safety protocol,<sup>16</sup> are mostly due to the surgeon's lack of expertise and experience,<sup>17</sup> technical deficiencies,<sup>18</sup> non-aseptic standards<sup>19</sup> or tumescent anaesthesia, with or without intravenous sedation.<sup>20</sup> Sepsis,<sup>4</sup> perforation of abdominal or thoracic viscera,<sup>5-7</sup> haemorrhages,<sup>5</sup> hypotension,<sup>21</sup> pulmonary embolism,<sup>5,15</sup> fat embolism,<sup>5</sup> pulmonary oedema and necrotizing fasciitis,<sup>8</sup> and cardiac arrest<sup>8</sup> have all been described in association with liposuction.

In the case described here, the cause of death was thrombosis of the basilar artery, with involvement of the AICA, PICA and spinal artery. The origin of the thrombotic event was traced to



an altered thrombophilic coagulation disorder due to surgery and probably also to the previously interrupted oral contraceptive therapy. Frequently described causes of death in cases of liposuction were excluded. In particular, autopsy findings showed the regularity of the atrial septum and excluded a patent foramen ovale, an anatomical condition necessary to justify the bypass filter in the case of cerebral fat embolism; the latter was also excluded by the absence of the typical purpura cerebri with petechial haemorrhages, confirmed by the negative extemporaneous histological examination performed on unfixed tissue by Oil Red staining.<sup>22</sup> Oil Red staining also excluded pulmonary embolism.

The physician's conduct in pre- and postoperative phases was considered correct. As regards the preoperative phase, no contraindications to surgery emerged during preanaesthetic assessment. In particular, the patient had a history negative for pathological thromboembolic risk factors. There were no known risk factors, such as inherent familiarity, oxidative stress, inflammatory processes, haemostasis (mutations regarding factor V Leiden, factor VII, factor II, platelet factor IV), homocysteinaemia, hypertension, diabetes, antitumour therapy, or progesterone and oestrogen therapy.<sup>23–26</sup>

No indications for thrombophilia panel test execution were recorded. Although some congenital defects of haemostasis, such as factor V Leiden (3–7%) and mutations in the gene for prothrombin 20210A (2–5%)<sup>27</sup> are frequently found in the general population, screening laboratory tests for thrombophilia are not normally carried out in healthy subjects, even when they are to be exposed to potentially thrombotic manoeuvres or interventions.<sup>28,29</sup> Laboratory tests should be restricted to those subjects who have had one or more thrombotic episodes in youth, particularly if spontaneous.<sup>30</sup> A positive family history may be considered in a woman who had previously used oral contraceptives, but should not be essential to initiate the subject to screening.<sup>30,31</sup> Testing for antiphospholipid antibody syndrome may be justified in patients with arterial thrombosis or well-defined pregnancy complications.<sup>31</sup>

Lastly, there was no evidence of any medical errors during either operative or postoperative phases.

In conclusion, the observed clinical events were considered predictable but unavoidable complications of a surgical procedure; no medical errors or malpractice were revealed. The Court of Law ruled the death as a fatal unforeseeable complication of the operation.

In our opinion, awareness of the complications related to liposuction surgery and familiarity with the postmortem findings frequently observed in liposuction-related deaths are essential for an accurate methodological approach in cases with possible civil and penal consequences. The physician's expertise and experience, and following a strict safety protocol can reduce but not exclude complications related to surgery.

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