Case Report and Literature Review:
Acute Pneumonitis and Alveolar Hemorrhage after Subcutaneous Injection of Liquid Silicone

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Abstract. Lay (non-medical) injection of silicone may lead to serious clinical consequences. Most reports of illicit cosmetic procedures have dealt with failed, lay attempts at breast augmentation. Although these procedures have resulted in severe pneumonitis and alveolar hemorrhage, reports of similar complication after lay attempts at buttock augmentation have been sparse. We describe one of these rare cases and review the literature on clinico-pathologic sequelae of lay attempts at cosmetic procedures using commercially available silicone preparations.

Keywords: silicone pneumonitis, silicone embolism, alveolar hemorrhage

Introduction
Silicone is a liquid polymer used commonly in cosmetic procedures mainly for correction of contour defects [1]. Silicone (polydimethylsiloxane) fluid is durable, undergoes little if any change in physical properties with aging, and lacks immunogenicity, leading to its wide applications in plastic and reconstructive surgery [2,3]. However, silicone is not completely inert and local complications (eg, infection, necrosis, and foreign body reaction) as well as systemic complications (eg, lymphadenopathy and acute febrile illness) have been observed in clinical trials [4,5]. In the United States, silicone is used by physicians for cosmetic operations. However non-medically supervised injection by lay persons has also been reported [6]. Injections of large amounts of silicone have resulted in migration of the silicone, granulomatous hepatitis, severe pulmonary reactions, and even death [7-9]. Most of these cases were due to pulmonary embolism, acute respiratory distress syndrome, or pneumonitis after subcutaneous silicone injection for augmentation mammoplasty in women or trans-sexual men. We describe a case of silicone pneumonitis, pulmonary embolism, and alveolar hemorrhage after non-medically performed sc injections of silicone into the buttocks for cosmetic purpose.

Case Report
An otherwise healthy, 30-yr-old woman presented with a 3-day history of shortness of breath, hemoptysis, and generalized weakness. She reported having pleuritic chest pain and productive cough during the past 3 days. The patient gave a history of smoking 2 to 3 cigarettes per day for 10 yr and using marijuana occasionally. She denied alcohol abuse or illicit iv drug use.

On physical examination, her body temperature was 100.4°F; pulse, 102 beats/min; blood pressure, 128/74 mm Hg; and respirations, 20 breaths/min. There were decreased breath sounds and coarse rales over the lung bases, and diffuse rhonchi throughout the lungs. Laboratory tests gave a blood...
white-cell count of 8,100/mm$^3$ and hematocrit of 35%. Arterial blood gas measurements were pH, 7.45; PaCO$_2$, 30 mm Hg; PaO$_2$, 80 mm Hg; HCO$_3^-$, 21 mmol/L; and O$_2$ saturation, 96% (on nasal catheter, 2 L/min O$_2$). Chest radiograph showed bilateral infiltrates in lower lobes, without any plural effusion (Fig. 1A). Computerized tomogram of the chest demonstrated bilateral fluffy alveolar lower lobe infiltrates (Fig. 1B).

Bronchoscopy was notable for dark bloody lavage fluid and submucosal bleeding in multiple segments of bronchioles (Fig. 1C). Tests for various etiologies of alveolar hemorrhages, including antiglomerular basement membrane antibody (ab), antinuclear ab, anti-cytoplasmic ab, cryoglobulins, and urine screen for cocaine, all yielded negative results. During her stay in the hospital, the patient became severely tachypneic and her blood O$_2$ saturation became reduced. The preliminary differential diagnoses included severe community acquired pneumonia, adult respiratory distress syndrome, and pulmonary interstitial disease.

The patient was started on ceftriaxone and azithromycin therapy; she was intubated electively for impending respiratory failure and transferred to the intensive care unit. Her boyfriend reported that the patient had received injections of an unknown volume of silicone fluid in both thighs, 3 days prior to the onset of symptoms, and that she had been injected twice in the same areas during the prior 3 months. Upon close examination, multiple puncture sites were found on the patient’s hips and buttocks. Five years previously, the patient had medically-performed augmentation mammoplasty with silicone implants, but CT scan did not reveal any leak or rupture of these implants.
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<th>Injection site</th>
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<tr>
<td>Price et al [19]</td>
<td>53/F</td>
<td>hip, buttock</td>
<td>2 hr</td>
<td>dyspnea, lethargy, confusion</td>
<td>alveolar hemorrhage, silicone emboli</td>
<td>not reported</td>
<td>resuscitation for cardiac arrest</td>
<td>no</td>
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<td>Schmid et al [15]</td>
<td>31/M</td>
<td>breast</td>
<td>1 da</td>
<td>cough, dyspnea</td>
<td>alveolar hemorrhage, silicone globules in alveoli</td>
<td>diffuse bilateral alveolar infiltrates</td>
<td>methylpredisolone</td>
<td>yes</td>
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<td>Pastor et al [18]</td>
<td>30/F</td>
<td>trochanter</td>
<td>3 da</td>
<td>dyspnea, fever</td>
<td>micro- &amp; macrovascular inclusions in macrophages</td>
<td>panlobar alveolar pattern with air bronchogram</td>
<td>methylprednisone high-flow oxygen</td>
<td>yes</td>
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<td>Chung et al [17]</td>
<td>44/F 39/F 32/F 58/F 46/F</td>
<td>vaginal wall</td>
<td>6 hr</td>
<td>unresponsiveness</td>
<td>silicone droplets in alveoli</td>
<td>extensive haziness in both lungs</td>
<td>none</td>
<td>no</td>
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<td>yes</td>
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<tr>
<td>Matsuba et al [14]</td>
<td>39/F</td>
<td>breast</td>
<td>2 da</td>
<td>cough, chest pain, dyspnea</td>
<td>hemorrhagic alveolitis, translucent globules</td>
<td>interstitial pulmonary infiltrates; peripheral non-segmental opacities</td>
<td>oxygen via nasal canula</td>
<td>yes</td>
</tr>
<tr>
<td>Chen et al [13]</td>
<td>34/F</td>
<td>breast</td>
<td>3 da</td>
<td>dyspnea, fever, nausea</td>
<td>vacuoles in pulmonary capillary and alveolar macrophages</td>
<td>bilateral diffuse alveolar infiltrates</td>
<td>corticosteroids</td>
<td>yes</td>
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<td>Lai et al [10]</td>
<td>28/F 33/F 32/F 31/F 37/F 34/F 30/F</td>
<td>breast</td>
<td>2 da</td>
<td>hemoptysis, dyspnea</td>
<td>pleomorphic cytoplasmic inclusions in alveolar macrophages</td>
<td>bilateral infiltrates with patchy airspace consolidation</td>
<td>oxygen via nasal canula</td>
<td>yes</td>
</tr>
<tr>
<td>Rodriguez et al [6]</td>
<td>37/M</td>
<td>hip</td>
<td>not known</td>
<td>dyspnea</td>
<td>many small globules occluding alveolar capillaries</td>
<td>not reported</td>
<td>mechanical ventilation</td>
<td>no</td>
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Bronchoscopy, performed in the operating room immediately before open lung biopsy, showed evidence of continuous bleeding from both main stem bronchi. Wedge resection of the right lower lobe was performed as well as upper lung biopsy. The H&E sections of the lung parenchyma showed acute alveolar hemorrhage with foci of early organization, diffuse interstitial lipoid vacuoles, and histiocytic reaction, consistent with silicone embolization (Figs. 2A,B). Antibiotic therapy was discontinued after the patient was transferred to the intensive care unit, and methylprednisolone was administered for 7 days. The patient was extubated on the sixth day; her clinical status gradually improved and she was asymptomatic at the time of discharge after 2 weeks of hospitalization. A chest x-ray performed 3 weeks later showed significant improvement of the pulmonary infiltrates. During the 8 months following discharge, the patient has not had any more silicone injections and she continues to do well.

Discussion

The injection by lay persons of liquid silicone for cosmetic purposes is an illegal practice in the United States. Its use was initiated in Asia [10] and later introduced in Europe [6,11] particularly among social groups that cannot afford conventional plastic surgery. Cases similar to our patient are infrequent in industrialized countries. Silicone fluid injection used for tissue augmentation can induce silicone emboli and has been implicated as a cause of acute pneumonitis and alveolar hemorrhage (Table 1).

Pulmonary silicone embolism may occur in numerous ways, but in cases of illegal silicone injection, it may be related to the high pressure needed for large-dose administration, local massage by the illegal practitioner, a migration effect, or accidental injection into the venous circulation [4,6,9]. Four histological patterns have been described in silicone lung injury: (a) the mere presence of silicone emboli, (b) congestion and alveolar hemorrhage, (c) acute pneumonitis, and (d) diffuse alveolar hemorrhage. Silicone deposits in small arterioles can increase pulmonary artery pressures sufficiently to cause cor pulmonale. The extent of pulmonary vascular bed obliteration determines the clinical status of the patient. The acute pneumonitis consists of lymphocytes, macrophages, neutrophils ingesting silicone, and alveolar hemorrhage with alveolar edema.

Silicone injection causes spillage of silicone liquid into the alveolar space after embolization to the lung. Localized cell-mediated inflammation that occurs with the influx of neutrophils, eosinophils, and alveolar macrophages plays an important role in the pathogenesis of silicone embolism [12]. Regarding clinical symptoms, patients present with dyspnea, cough, fever, chest pain, hemoptysis, or loss of consciousness (Table 1). Loss of consciousness is a poor prognostic factor, which indicates brain hypoxia [13]. Our case demonstrates the introduction of silicone into the general circulation, causing systemic silicone emboli to the lungs. No specific site for vascular infiltration was identified in our case; however many injection sites were observed on the thighs and buttocks. The amount of silicone injected is unknown in our case.

Two forms of pneumonitis following silicone injection have been described. An acute form, which occurs immediately or a few days post-injection, as seen in our patient, consists of sudden onset of shortness of breath, fever, mild to moderate hypoxemia, tachycardia, and occasionally, acute respiratory failure. Radiographs typically show a bilateral alveolar pattern with patchy areas of consolidation. Our patient had bilateral alveolar infiltrates especially in the posterior segments of the lungs, suggestive of multiple pulmonary embolisms. The treatment is usually rest, high-flow oxygen inhalation, and mechanical ventilation in some cases [6,10,14]. There is no consensus regarding therapy with corticosteroids, as outcomes associated with their use are not well established (Table 1). Early corticosteroid treatment might be helpful in reversing the clinical course. Patients usually recover without sequelae, but pulmonary fibrosis has been described in patients who survive an acute event [13].

A latent form of pneumonitis that appears up to 6 months after the last silicone injection has also been described; these patients usually present with local swelling at the injection site and mild respiratory symptoms.
Lai et al [10] reported 7 cases of silicone pneumonitis after silicone injection for augmentation mammoplasty. The patients presented with hemoptysis, dyspnea, and/or fever of 1 to 3 days duration. Light microscopy showed large pleomorphic cytoplasmic inclusions in alveolar macrophages. The patients all improved after oxygen supplementation via mask or nasal canula. The few days delay in onset of symptoms after silicone injection might be due to widely dispersed small-size particles of silicone having been released into the circulation, and subsequent embolization to the lungs. Intravascular injection would likely cause immediate embolism and a sudden onset of symptoms.

Schmid et al [15] noted similarity between the clinical presentation of patients with fat embolism and silicone embolism, and deduced that the pathogenesis may be similar. In fat embolism, histologic examination of the lungs demonstrates diffuse alveolar damage with fat globules in the pulmonary microcirculation. As macrophages ingest silicone, an inflammatory response is produced, activating endothelial cells, increasing capillary permeability, and modulating immunoregulatory responses in the alveoli [16].

Chung et al [17] reported the pathology caused by illegal silicone injections in 5 patients. Two of the patients died within 15 hr, and two more died after 5 days and one month, respectively. Microscopic findings were silicone emboli, intra-alveolar hemorrhages, and foreign body reaction. The authors concluded that silicone injections can produce acute pulmonary disease in only a few hours after injection. Silicone emboli were detected in pulmonary vessels of a patient who died 10 hr post-injection, which supports the assumption that silicone fluid injections result in local tissue damage and eventually gain access to the bloodstream to cause embolization in the lung.

In summary, silicone embolism can occur as a result of penetration of silicone via increased perivascular tissue pressure, direct injection into vessels, or local massage after injection of large amounts of silicone. Our case showed silicone pneumonitis and pulmonary hemorrhage after illegal silicone liquid injections into the buttocks resulting in systemic embolization. When acute respiratory failure occurs in patients with a history of cosmetic procedures for tissue augmentation or correction of contour, silicone embolism should be included in the differential diagnosis.

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References