Irreversible Muscle Damage in Bodybuilding due to Long-Term Intramuscular Oil Injection

Abstract

Intramuscular oil injections generating slowly degrading oil-based depots represent a controversial subject in bodybuilding and fitness. However they seem to be commonly reported in a large number of non-medical reports, movies and application protocols for ‘site-injections’. Surprisingly the impact of long-term (ab)use on the musculature as well as potential side-effects compromising health and sports ability are lacking in the medical literature. We present the case of a 40 year old male semi-professional bodybuilder with systemic infection and painful red-dened swellings of the right upper arm forcing him to discontinue weightlifting. Over the last 8 years he daily self-injected sterilized sesame seed oil at numerous intramuscular locations for the purpose of massive muscle building. Whole body MRI showed more than 100 intramuscular rather than subcutaneous oil cysts and loss of normal muscle anatomy. 2-step septic surgery of the right upper arm revealed pus-filled cystic scar tissue with the near-complete absence of normal muscle. MRI 1 year later revealed the absence of relevant muscle regeneration. Persistent pain and inability to perform normal weight training were evident for at least 3 years post-surgery. This alarming finding indicating irreversible muscle mutilation may hopefully discourage people interested in bodybuilding and fitness from oil-injections. The impact of such chronic tissue stress on other diseases like malignancy remains to be determined.

Introduction

In bodybuilding and fitness, many unnatural substances with legal or illegal use are employed to gain muscle enlargement, strength and definition [2]. Beside their stimulating effects on the musculoskeletal system a large variety of severe side effects after short- as well as long-term abuse of these substances is well known [6]. Intramuscular oil-injections that generate slowly degrading oil-based depots (personal communications) are used for 2 purposes – to enlarge the size of a muscle or to shape a muscle. These implants represent a controversial subject in bodybuilding and fitness. Nevertheless this so-called ‘site enhancement’ introduced in the 1980’s seems to be frequently used in bodybuilding and fitness. As reported by our patient and proven by the authors in extensive Internet research using the commercially available product names as key words this is displayed by a large number of up to date reports, movies and application protocols for ‘site injections’ in the body press, Internet and even on the homepages of ‘site enhancement oil’ distributing companies. The key effect of intramuscular oil injections on the musculature is thought to rely on the stretching of the respective muscle fascia due to the encapsulated slowly degrading intramuscular oil implants. As reported by our patient in the body-building scene the fascia itself is thought to be a major restrictive factor in muscle growth. After delayed dissipating of the encapsulated oil over several months the pressure in the muscle fascia is believed to be decreased enabling further volume gain of musculature. This is meant to enable a muscle to break past a plateau (sticking point) for further gain of muscle volume up to the desired muscle size and definition.

The composites used for injection are called ‘site enhancement oils’ containing predominantly medium-chain triglycerides (mct), local anaesthetics and alcohol. Additionally, silica to extend the duration of the volume gain, anabolic steroids, prohormones or collagen are infrequently added to these preparations. These products are...
produced, bottled, and sealed often under pharmaceutical grade conditions and labelled as sterilized posing oils or ‘site enhancement oils’ that are commercially available. Composites most frequently associated with ‘site enhancement’ are Synthol, PumpnPose, Syntherol™, EsikClean, Nuclear Nutrition Site Oil, Cosmostan and Liquid Muscle. They are expensive, especially when used frequently. Thus, less costly sterilized natural oils such as sesame seed [1,3,8] and walnut oils [10] are alternatively employed.

The typical application protocols involve frequent injections of 1–3 ml daily in repeated locations within the target muscles for durations of several weeks to 6 months or more. Injecting in distinct muscle locations and massaging the area after the injection is thought to produce a natural look to the musculature and prevent the development of scar tissue. However, the potential long-term presence of encapsulated oil and relevant long-term side-effects associated with intramuscular oil injections are often negated especially when using commercially available composites.

In contrast to the extensive amount of reports, movies and instructions for intramuscular oil injections in lay press and Internet for more than 20 years only 4 brief case reports have been published in the medical literature [1,3,8,10]. They describe palpable and rarely painful subcutaneous rather than intramuscular nodules after several months up to 2 years of self-injection of sesame seed or walnut oil for muscle enlargement [1,3,8,10]. Signs of infection or enlarged axillary lymphatic nodes were predominantly absent. Edema of affected muscles is mentioned only in 1 case 1 week after self-injection [8]. Diagnostic (skin-muscle) biopsies revealed oily cysts/oleomas surrounded by granulomatous and fibrotic tissue with chronic foreign body reaction and panvasculitis [1,3,8]. Conservative treatment was performed. However, serious short-term side effects requiring extensive surgical intervention with septic complications are not mentioned. Nor are appropriate imaging studies describing the vitality of the target musculature especially after long-term abuse. Long-term or permanent side effects with possible influence on physical health, sports ability and quality of life are not addressed. This is surprising considering a large quantity of intramuscular injections are typically performed without medical supervision when employing this augmentation method. Lack of reports describing the short- and long-term risks of intramuscular oil injections may lead to a continuing trivialization of this invasive muscle enlargement and shaping method.

**Case Report**

A 40 year old white semi-professional bodybuilder presented with multiple painful swellings, redness and hyperthermia of the right upper arm for 2 months, mainly located at biceps brachii muscle. The swellings had been continuously growing in size over the course of time. Feeling sick with elevated body temperature, daily weightlifting had been discontinued for 2 months. After the diagnosis of a “rupture of muscle fibres” by previously consulted physicians, conservative treatment with complete training interruption and non-steroidal anti-inflammatory drugs had been unsuccessful. The general history was free of trauma, night sweating, weight loss, cancer or other relevant disease. For the last 8 years until 4 months before admission, the patient reported weekly self-injections of 2 ml of sterilized sesame seed oil at 20 intramuscular locations, resulting in massive muscle building with an upper arm circumference of up to 70 cm (Fig. 1a). He described this as a well-known and side effect free muscle augmentation and shaping method in bodybuilding.

The examination revealed elevated body temperature of 37.8 °C (axillary), white blood cell count of 10×10⁹/L, and C-reactive protein of 48 mg/L.

The physical examination of the right upper arm revealed a painful swelling with inflammatory signs such as redness and hyperthermia, mainly located at the medial aspect of the biceps brachii muscle. The swelling was about 13×7 cm in size (Fig. 1b) and highly sensitive to palpation. Enlarged axillary lymph nodes were evident. The range of motion of the right shoulder and elbow were normal. An examination of the left arm, breast, neck, abdomen and upper legs revealed multiple painless subcutaneous as well as intramuscular swellings without signs of inflammation.

A conventional X-ray examination of the right upper arm revealed hypertrophic musculature and cortical thickening of the humerus as typically seen in weight-lifters [11]. In the soft
tissue multilocular wall calcified necrotic lesions were evident (Fig. 2).
Contrast-enhanced whole body MRI was made for an infection focused search. It showed more than 100 intramuscular and some subcutaneous oil cysts up to 7 cm each with no obvious signs of infection in the left upper arm, both shoulders, legs and breast. Their location reflected the frequently used injection sites of the last 10 years. In the right upper arm dramatic loss of normal muscle anatomy was obvious (Fig. 3a–c). Oil cysts could be ubiquitously found with nearly full replacement of the brachialis muscle (Fig. 3a). The whole right biceps brachii muscle and the long as well as the lateral head of the right triceps brachii muscle were replaced by fibrotic and necrotic scar tissue with concomitant edema. Only in the medial head of the triceps muscle apparently healthy musculature could be found.

In the painful and reddened skin exhibiting medial aspect of...
biceps brachii muscle, connected oil cysts, fibrotic tissue and diffuse edema with high signal on T2-stir-weighted images were predominant (Fig. 3b).

Clinical and imaging data were highly suspicious of an infection of the right upper arm. Thus septic surgery was performed after exclusion of pulmonary oil embolism. After a 15 cm incision over the medial aspect of biceps brachii muscle, fibrotic scar tissue with increased bleeding could be found. At the proximal aspect of the short head of the biceps brachii muscle, the opening of a fistulated abscess formation drained about 15 ml of pus (Fig. 4a). Another abscess formation could be opened at the distal aspect of the short head of the biceps brachii muscle. Surrounding fibrotic and necrotic tissue incorporating oil and pus filled cystic scar formations. Complete absence of healthy muscle was conspicuous for the upper arm of this patient. Even after further careful debridement of the fibrotic and edematous tissue healthy muscle could not be reached in the depth (Fig. 4b). To prevent a gross structural defect by further resection 2-step septic surgery was performed using Vacu-Seal™. After pulse lavage a sponge was placed in the former abscess formation and left for 5 days with continuous suction (Fig. 4c).

A long-term microbiological analysis of the sterilized (pharmacy) sesame-seed oil from the patient’s home kept for future injections as well as of intraoperatively gained pus, oil and scar tissue revealed no evidence of bacteria or fungi after 10 days of incubation.

In the histopathologic examination most parts of the muscular tissue were replaced by fibrosis (Fig. 5a) and chronic resorptive inflammation with extensive abscess and granuloma formation. The inflammatory tissue contained numerous oil cysts with foreign body giant cells (Fig. 5a). In addition, there was widespread secondary vasculitis. Areas of fresh muscle necrosis and atrophy were also present (Fig. 5d). The diagnosis of a partially inflamed and necrobiotic oleoma with irreversible loss of healthy muscle was made.
5 days after the first operation when blood infectious parameters had decreased the sponge was removed and the granulated wound was closed. The patient was discharged 5 days later with unsuspicious wound conditions. 1 year later he still suffered from persistent pain without signs of infection making his usual daily weight-lifting impossible. The concomitant loss of muscle mass and definition was most pronounced in the muscle that had not received oil injection or that had received a smaller number of injections. Interestingly, the diameter and aspect of his upper arms, the site of the most frequent oil injections were nearly unchanged over the course of time. In accordance with that a contrast-enhanced MRI of the right upper arm showed a similar picture compared to preoperative condition with enlarged axillary lymph nodes and replacement of musculature by oil cysts, fibrosis and necrosis (Fig. 3d, e). A relevant regeneration of the muscle could not be found despite believable abstinence from any artificial enhancement including substitutes, drugs or (oil) injections for nearly 1 ½ years. 3 years after the operation the patient still suffered from moderate pain and weakness especially in both upper arms allowing only a reduced training intensity.

Discussion

Intramuscular oil injections or ‘site enhancement’ represent a controversial subject in bodybuilding and fitness. Introduced in the 1980’s ‘site enhancement’ allows (ab)users to achieve muscle size and shaping which was previously unimaginable even with the best genetic disposition, use of natural and unnatural substances and the toughest training regimen imaginable [2]. Their use is still popular amongst bodybuilding and fitness circles, proved by the large amount of up-to-date reports, movies and application protocols for ‘site injections’ in the lay press, Internet and on the homepages of ‘site enhancement oil’ distributing nutritional supplement companies. The information given in the few existing medical case reports as well as the statement from our patient of numerous frequent male and female users strongly support this [1,3,8,10]. However to our knowledge only 4 medical case reports have been published up to now [1,3,8,10]. This is surprising considering how, where and by whom these multitude of injections are performed. Misdiagnoses, which occurred in our case with the previously diagnosed “ruptured muscle fibres”, may be an explanation possibly leading to an ongoing trivialization of this extreme muscle enlargement and shaping method. All medical reports fail to mention severe short-term side effects [1,3,8,10]. As shown here severe abscess forming infections with enlarged axillary lymphatic nodes and increased systemic infection parameters may occur even 2 months after the last injection. In contrast to previous case reports 2-step septic surgery with a large-scale approach necessary to drain the abscess formations could not be avoided.

Without knowing the location of nerves or vessels it is possible to hit these by accident especially with deep intramuscular oil injections. As is known from the injection of vegetable oils for other cosmetic purposes fatal systemic complications such as pulmonary fat embolism, life-threatening neurological complications or multiple organ failure may result [4,7,13]. In medical literature the central question how long-term intramuscular oil injections that generate slowly degrading oil-based intramuscular depots affect the respective musculature in terms of anatomy and vitality, has not been addressed yet. Our patient performed frequent intramuscular oil injections for 8 years exceeding by far the published periods ranging from 5 separate injections [8] up to multiple injections for 2 years [3]. However he reported such a period not to be unusual in bodybuilding and fitness circles. By a whole body MRI more than 100 intramuscular rather than subcutaneous oil cysts even in regions such as legs and the breast which had not been injected for more than 2 years were detected. In contrast to the non-medical reports and application protocols in the lay-press and Internet this is evidence for the first time that the degrading implants obviously stay longer in the muscle than just a few months. A dramatic loss of normal muscle anatomy and vitality was most obvious in the right upper arm displaying the location of the most frequent injections. In imaging and histology more than 90% of superficial as well as deep musculature had been replaced by oil cysts, fibrotic and necrotic scar tissue. Interestingly such extensive muscle damage has not been reported up to now. Using ultrasound imaging just some oil cysts [1,3], using focal MRI performed after only 5 separate injections [8], at least muscle oedema with suggestion of local necrosis could be found. Histopathological analysis is always limited by its focal character. Thus in the existing case reports the found tissue alterations such as focal inflammation [1,8] and necrosis [1] give no information about the morphology and vitality of the whole muscle itself. In a follow-up MRI 1 year later the irreversibility of this phenomenon became evident. Despite a believable abstinence of any artificial enhancement for nearly 1 ½ years the right upper arm showed a similar picture compared to the pre-operative status. Relevant muscle regeneration seemed to be absent in accordance with the ongoing complaints of the patient not being able to carry out normal weightlifting. This may explain his reduced sports ability leading to a long-term diminished quality of life even 3 years after operation. This is the first time that irreversibility of muscle mutilation by intramuscular oil-injections has been proven. The existing case reports lack any follow-up imaging [1,3,8,10]. Interestingly all medical reports involve self-injections with natural oils [1,3,8,10] and not the commercially available composites. However, sesame seed oil is frequently used as a solvent in formulations for intramuscular injections, for example in anabolic steroids or gold injections for rheumatoid arthritis [12]. The sesame seed oil sterilized by a pharmacy and used by our patient as well as the intraoperatively gained probes were free of bacteria or fungi.

This report shows for the first time vast and apparently irreversible damage of the musculature after long-term intramuscular oil-injection for muscle augmentation and shaping. If the chronic tissue stress associated with this mutilation of the body may promote other diseases like malignancy remains open [9]. We hope that this alarming finding helps colleagues with similar cases as well as discourages the use of intramuscular oil injections for people in the bodybuilding and fitness scene.

Ethical Standards

Written informed consent from the patient for this case report was obtained. Investigational Review Board approval is not required for a case report [5].
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References
9 Kundu JK, Surh Y. Inflammation: gearing the journey to cancer. Mutat Res 2008; 650: 15–30
10 Munch IC, Hvolris Jl. Bodybuilding aided by intramuscular injections of walnut oil. Ugeskr Laeger 2001; 163: 6758