Effect of subcutaneous phosphatidylcholine injection used in the treatment of localized obesity on the histological structures of human skin and subcutaneous tissue: a pilot study

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Background
Multiple clinical trials have supported the idea that subcutaneously injected phosphatidylcholine (PPC) leads to a reduction in localized fat collection. However, only a few histological studies that explain the mechanism of action of PPC have been published.
Aim
This study aimed to evaluate the clinical and detailed histological changes in the skin and subcutaneous tissue after PPC injection.
Patients and methods
Ten female patients with local fat deposits (upper outer thigh) were assessed after a single session of subcutaneous injection with PPC on the basis of thigh circumference measurement, and histological examination of skin biopsy specimens was carried out before and 1 and 2 months after treatment. Histological sections were stained with H&E, Masson's trichrome (for collagen fibers), and by aldehyde fuchsin (for elastic fibers), followed by morphometric study and statistical analysis.
Results
Two months after injection, a statistically significant reduction in thigh circumference was found (P=0.045), with leathery tight skin texture at the injected area. Histological examination revealed dermal inflammatory responses 1 month after injection, with destruction of fat cells. These observations were reduced after 2 months with evidence of regenerating fat cells. Statistical analysis showed a significant increase in collagen area% (P=0.025) and statistically nonsignificant increase in elastic fiber area% at the end of the study.
Conclusion
A single session of subcutaneous PPC injection had an evident lipolytic effect, with noticeable contouring and skin tightening due to regenerative effect on skin connective tissue, particularly dermal collagen. However, lipolytic effect was partially temporary because of regeneration of fat cells.

Keywords:
collagen fiber, elastic fiber, lipolysis, phosphatidylcholine

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Introduction

Localized collection of excess fat and obesity in general can be medically dangerous and psychologically distressing to patients. There has been renewed interest in the technique of mesotherapy as a method of reducing localized subcutaneous fat for body contouring [1].

Phosphatidylcholine (PPC) was initially used in emergencies in the treatment of atheroma plaques in cardiac diseases. Later it came to be used in the treatment of localized fat deposits [2]. Multiple clinical trials supported the idea that subcutaneously injected PPC leads to a reduction in the volume of adipose tissue [3,4]. However, only a few histological studies that explain the mechanism of action of PPC have been published. One of them showed that lipolysis injection with PPC causes tissue fibrosis and necrosis of adipose and vascular tissues [5]. A previous study revealed fat reduction and skin tightening in all participants included in the study [6].

The aim of this study was to evaluate the effect of a single session of subcutaneous injection with PPC on 10 female patients presenting with local fat deposits in the upper outer thighs. This evaluation included circumference measurements as well as histological examination before and 1 and 2 months after treatment.

Patients and methods

Patients

At the beginning of the study 20 female patients presenting with localized fat deposits (upper outer thighs)

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were recruited from the Dermatology Outpatient Clinic, Ain Shams University Hospital, after obtaining informed written consent. Their ages ranged from 25 to 35 years. While recruiting patients to be included in the study, women who were or might be pregnant, lactating women, patients with an allergy or sensitivity to soy products (as PPC is extracted from soy beans), those who had a serious ongoing systemic illness, and women with an open sore or lesion in the treatment region were excluded. Patients on ibuprofen, aspirin, or anticoagulant-type medication, or with conditions that might create a suppression of the immune response, were also excluded.

A second selection of patients was done by recording their height and weight for calculation of BMI, and obese women (BMI>30 kg/m^2) were excluded from the study. Hence, only women with BMI less than 30 kg/m^2 and with localized fat deposits in the upper outer thigh were included in the study. However, five patients were lost to follow-up 2 months after injection and five patients were excluded because of significant changes in their weight, which were likely to affect the study outcome. Thus, 10 patients completed the study. The study was conducted according to the Declaration of Helsinki principles, and was approved by the medical ethical committee of Ain Shams University. Each patient gave a detailed history, and clinical examination was also performed, including vital signs and review of other systems. A third selection of patients was carried out by checking their weight before injection and 1 and 2 months after injection, and patients who gained or lost more than 4 kg during the study were excluded (so that, the lipolytic effect of PPC is studied precisely without any external effect on lean mass) [6].

Local examination of the fat deposit of patients was performed and measurements of the circumference (from midline to midline crossing the site of the injection at the level of the hip joint) before injection and after 1 and 2 months were reported. Three groups were considered: group I included patients whose data were recorded before injection; this group was considered the baseline control group. Group II included all patients whose data were recorded 1 month after injection. Finally, group III included all patients whose data were recorded 2 months after injection.

Methods

Injection methodology

PPC was prepared (Net Work, Toskanini, Germany) in the form of 5 ml ampoules containing 250 mg PPC/5 ml. The injected formula contained:

(1) One ampoule of PPC (250 mg/5 ml).
(2) An activator (pentoxifylline B complex containing pentoxifylline 100 mg/5 ml, vitamin B complex 33 mg/5 ml, and sodium chloride 35 mg/5 ml).
(3) The two compounds were mixed with each other at a ratio of 5 ml of PPC and 0.25 ml of the activator, and then diluted with 4.75 ml of 0.9% normal saline. Thus, the total volume injected was 10 ml for each side.

After good sterilization with absolute alcohol and then with hydrogen peroxide, the prepared formulation was injected into the subcutaneous tissue at a depth of 10 mm using 30 G/25 mm needles. At each point, 0.5 ml of the formulation was injected perpendicular to the surface of the treated area following a grid pattern, spacing injections 1.5 cm apart by using a 5-needle linear multi-injector connector (Fig. 1). Each patient received only one ampoule [7].

The patients were advised to treat the area with compressive clothing to reduce edema, and to take acetaminophen for the first 24–48 h to reduce pain.

Treatment evaluation

Patients were evaluated by circumference measurement at baseline and 1 and 2 months after injection [group I (the control group), group II, and group III, respectively]. Immediate and late local and general side effects reported in each patient were recorded, along with the severity and duration of each side effect. In addition, each patient was asked about her satisfaction as regards both efficacy and safety, and this was recorded.

For histological assessment, punch biopsy was taken using a 3 mm sterile biopsy punch from the area of treatment before injection for a baseline histological examination, which was repeated 1 and 2 months later. The biopsy site was well-dressed with application of topical fusidic acid cream twice daily for 1 week.

The skin specimens were divided into three groups, similarly to the patient groups: group I included all biopsies taken just before injection, group II included all biopsies taken 1 month after injection, and group III included all biopsies taken 2 months after injection.

Immediately after taking the skin sample, specimens were fixed in 10% buffered formalin and processed for paraffin block formation. Serial sections of 5–8-μm thickness were cut and stained with H&E for demonstration of epidermal, dermal, and fat changes, Masson's trichrome for demonstration of collagen fibers (stained blue), and aldehyde fuchsin for demonstration of elastic fibers (stained violet) [8].

Morphometric study

Two slides for each patient were examined and 10 readings were obtained for each slide and the mean values were obtained using a low-power lens.

The following parameters were measured:

(1) Area% of collagen (using Masson's trichrome-stained sections).
(2) Area% of elastic fibers (using aldehyde fuchsin-stained sections).

Morphometric data were obtained using a Leica Qwin 500 image analyzer computer system (UK) in the department of Histology, Cairo University, Egypt.

Statistical analysis

The collected data were statistically analyzed using statistical packaging for social sciences (SPSS, version 17; SPSS Inc., Chicago, Illinois, USA). Descriptive

statistics were presented for numerical parametric data as mean ± SD and minimum and maximum values. Inferential analyses were carried out using the Freidman test for comparison between two groups of quantitative data. The level of significance was taken at *P* value less than 0.05.

Results

Clinical results

At the first follow-up visit (after 1 month), seven patients (70%) showed decreased thigh circumference at the injected area, whereas two (20%) showed no change, and one (10%) showed increased thigh circumference at the injected area. At the end of the study (after 2 months), five patients (50%) showed decreased thigh circumference at the injected area, four patients (40%) showed no change from baseline (although two of them previously showed a decrease in thigh circumference 1 month after treatment), and one patient (10%) showed increased thigh circumference at the injected area. Comparison of mean thigh circumference at the injected area throughout the study showed that the circumference of the injected area initially decreased (in group II) and then increased (in group III) but was still lower than the baseline circumference (in group I). The change throughout the study was statistically significant (*P*=0.045) (Table 1 and Histogram 1). All patients had evident clinical improvement (supported by metric measurement) with respect to contouring of the injected area. In addition to skin tightening noticed by patients and confirmed by examination the skin felt leathery at the end of the study.

With regard to side effects, we reported pain, a stinging and burning sensation, erythema at the injected area and itching, and subcutaneous nodules in all patients. Edema, swelling, and induration were found in 70% of patients. Bruising was seen in 60% of patients, and 20% of patients complained of a few systemic cholinergic symptoms (dizziness/light headedness, malaise/nausea). As regards patients' satisfaction, all patients showed a certain degree of satisfaction with treatment except one patient, who had no improvement. Five patients (50%) showed a moderate degree of satisfaction and four patients (40%) showed a high degree of satisfaction.

Histological results

Group I

Histological examination of H&E-stained sections showed the skin to be formed of epidermis and underlying dermis. The epidermis appeared to consist of stratified squamous keratinized epithelium. The dermis was formed of connective tissue containing hair follicles and sweat and sebaceous glands. The dermis was divided into two layers. The papillary layer was the thin superficial layer. It consisted of loose connective tissue rich in blood vessels. The reticular layer is the thick deep layer. It is formed of dense connective tissue and appeared less vascular (Fig. 2a and b).

The subcutaneous tissue or hypodermis appeared deeper to the dermis and consisted of loose areolar connective tissue rich in unilocular fat cells. Fat cells appeared in the H&E section as a thin ring of cytoplasm surrounding a large vacuole left by dissolved lipid. The nucleus of unilocular fat cells of the hypodermis appeared eccentric and flattened as it was pushed laterally by the large fat vacuole, giving a signet ring cell appearance (Fig. 3).

In Masson's trichrome-stained sections, collagen fibers appeared blue in color. Collagen fibers of the papillary dermis appeared as a fine condensed zone just beneath the epidermis. In the reticular dermis, collagen bundles appeared to be formed of thick, wavy collagen bundles of uniform diameter running in different directions and forming an interlacing network (Fig. 4a and b). The collagen fibers appeared fine and condensed around the hair follicles and sebaceous glands (Fig. 4a).

In aldehyde fuchsin-stained sections, elastic fibers appeared violet in color in the dermis. Superficial elastic fibers just under the epidermis were thin, whereas deeper elastic fibers in the reticular layer appeared thick, long, and branched (Fig. 5a and b).

Group II

Histological examination of H&E-stained sections showed an apparent increase in the number and size of subepidermal capillaries, which appeared congested and showed perivascular inflammatory infiltrate (Fig. 6a and b). The hair follicles, sebaceous glands, sweat glands and ducts showed no apparent changes, apart from periappendageal mononuclear cellular infiltrate as a part of the general inflammatory process with some tissue spaces. No apparent changes were noticed in the epidermis.

The subcutaneous fat of the hypodermis showed destruction and distortion of the wall of fat cells, which were evident in most cases (Fig. 7).

Examination of Masson's trichrome-stained sections showed irregular collagen fibers running in different directions and deposited in coarse bundles. Apparent proliferation of the subpapillary vascular plexus was also noticed when compared with group I (Fig. 8a and b).

Examination of aldehyde fuchsin-stained sections showed some changes in the amount and morphology of elastic fibers of the reticular dermis in relation to group I. They appeared thicker, more tortuous, and more branching compared with group I (Fig. 9).

Group III

Histological examination of H&E sections of group III revealed changes in relation to group I and group II.

Different inflammatory signs seen in group II persisted in most patients of group III but inflammation was milder. No apparent change in the epidermis was noticed (Fig. 10a and b).

Fat cells appeared distorted in some areas, whereas intact fat cells started to appear again in subcutaneous tissue in most of the cases (Fig. 11).

In one case an intense inflammatory infiltrate was present at the dermal–subcutaneous interface and in the adipose tissue. There was a mixed inflammatory infiltrate, involving the deep dermis and subcutaneous tissue. There was also evident vascular proliferation consisting of arteries, veins, and lymphatics. Inflammatory infiltrates outlined the individual adipocytes, giving a lacy pattern (Fig. 12).

Examination of Masson's trichrome-stained sections showed subepidermal infiltration and irregular collagen fibers running in different directions (Fig. 13a and b).

Examination of aldehyde fuchsin-stained sections showed apparent changes in the amount and morphology of elastic fiber of the dermis in relation to group II. Elastic fibers of the dermis appeared thick and tortuous (Fig. 14a) and to be formed mainly of tangled amorphous elastic materials that replaced the thin branching elastic fibers of group I (Fig. 14a and b).

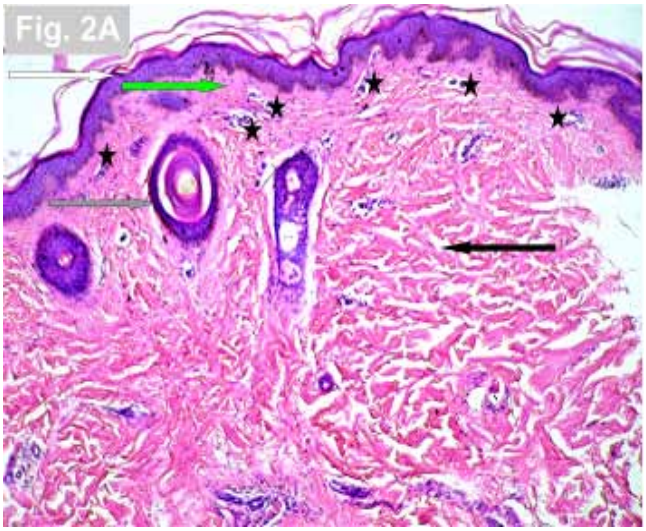
Morphometric and statistical results

An analysis of the thigh circumference at the injected area throughout the study showed that the circumference of the injected area was initially decreased and then increased but was still lower than the baseline circumference. The change throughout the study was statistically significant (P=0.045) (Table 1 and Histogram 1).

The mean collagen area% was 29.4 ± 10.5 at the beginning of the study and was reduced to 24.9 ± 9.5 1 month after treatment, and at the end of the study it was elevated to 31.8 ± 9.7. Comparison of the changes in collagen area% throughout the study revealed that the collagen area% had increased, and the results were statistically significant by the end of the study (P=0.025) (Table 1 and Histogram 1). The area% of elastic fibers was 7.4 ± 2.0 at the beginning of the study and was reduced to 6.5 ± 1.9 1 month after treatment, and at the end of the study it had increased to 7.6 ± 2.9. Comparison of the changes in area% of elastic fiber revealed increased area% of elastic fibers at the end of the study, but the results were statistically nonsignificant (Table 1 and Histogram 1).

Fig.1

Figure 1. A photomicrograph of a five-needle linear multi-injector connector used for lypolysis injection.



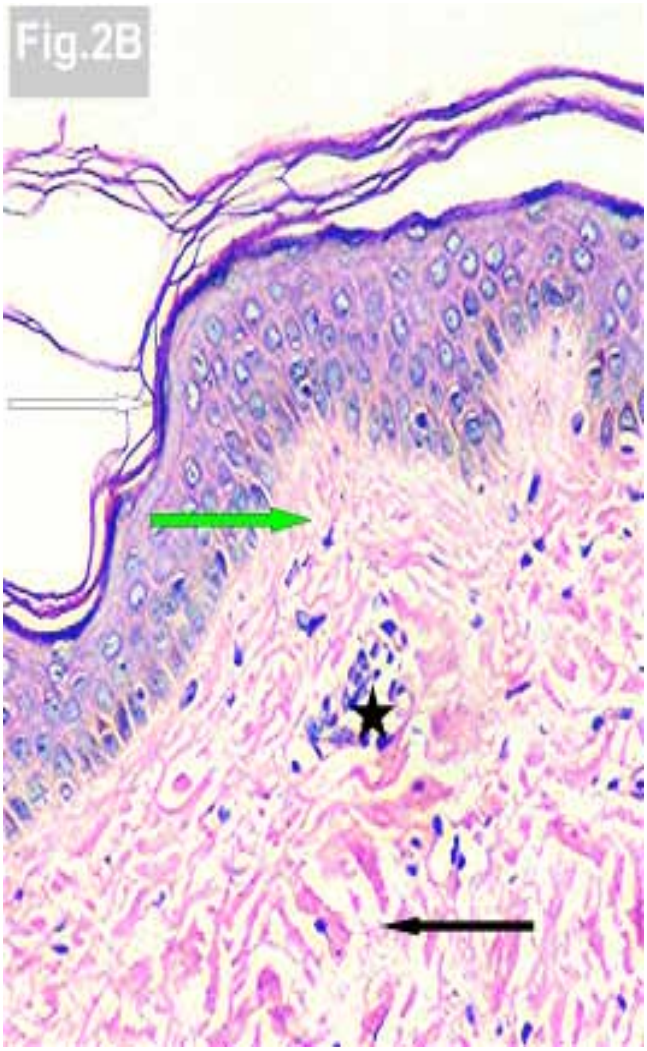


Figure 2. (a) Photomicrograph of a skin section of group I showing the epidermis (white arrow); the dermis appears to be formed of a superficial papillary connective tissue layer just beneath the epidermis (green arrow) and a deep reticular connective tissue layer (black arrow) containing hair follicles (gray arrow). The boundaries between the papillary and reticular connective tissue of the dermis contain the subpapillary vessels (black stars). (b) A photomicrograph of the skin section of group I showing the epidermis formed of stratified squamous keratinized epithelium (white arrow) and the dermis formed mainly of connective tissue (black and green arrows). Note subpapillary blood vessels (black star) between the papillary dermis (green arrow) and reticular dermis (black arrow).

H&E stain, (a) × 100; (b) × 200.

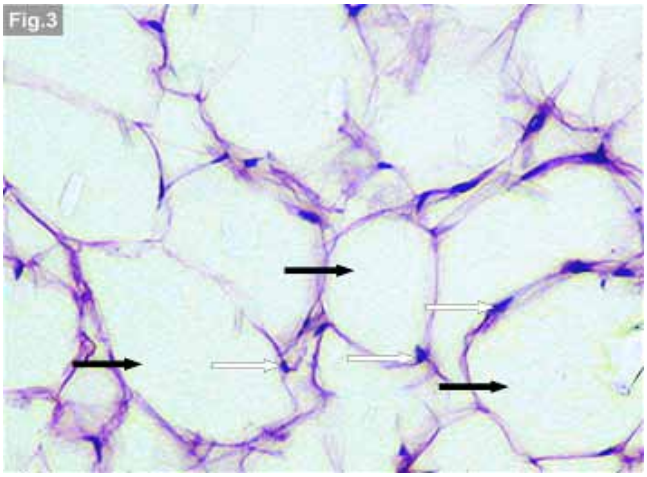


Figure 3. A photomicrograph of the subcutaneous tissue of group I showing unilocular subcutaneous fat cells (black arrows) with eccentric flattened nuclei (white arrows) giving a signet ring appearance.
H&E stain, × 720.

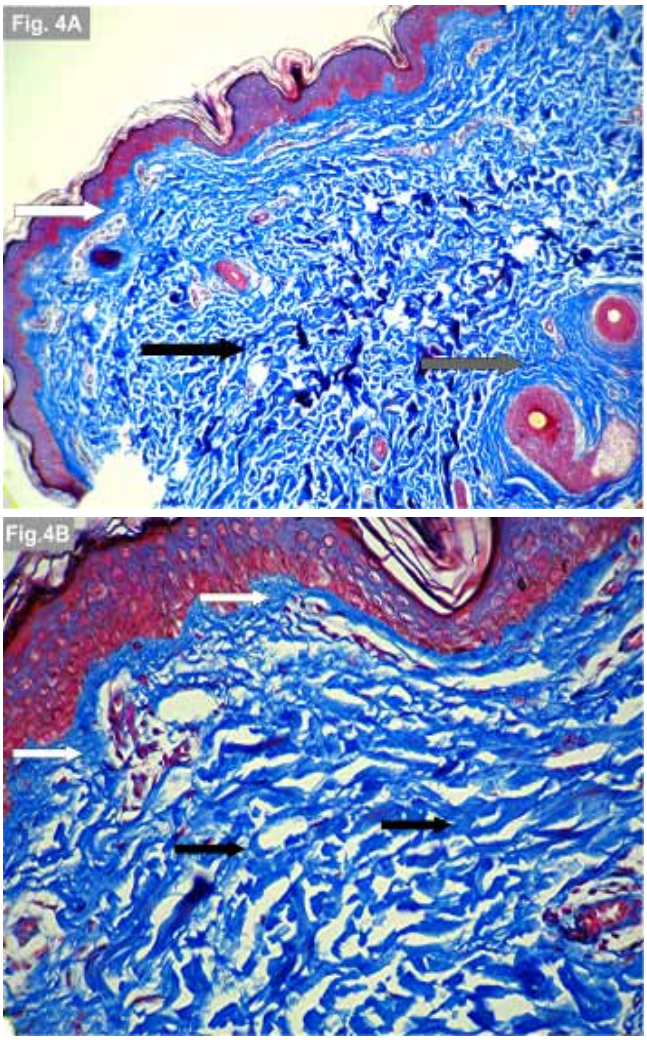


Figure 4. (a) A photomicrograph of the skin of group I demonstrating fine subepidermal papillary collagen fibers (white arrow) and dense, coarse, irregular collagen fibers of reticular dermis (black arrow). Note fine collagen fibers around the hair follicle (gray arrow). (b) A photomicrograph of the skin of group I demonstrating fine subepidermal papillary collagen fibers (white arrows) and coarse irregular collagen fibers of reticular dermis (black arrows).
Masson's trichrome stain, (a) × 100; (b) × 200.

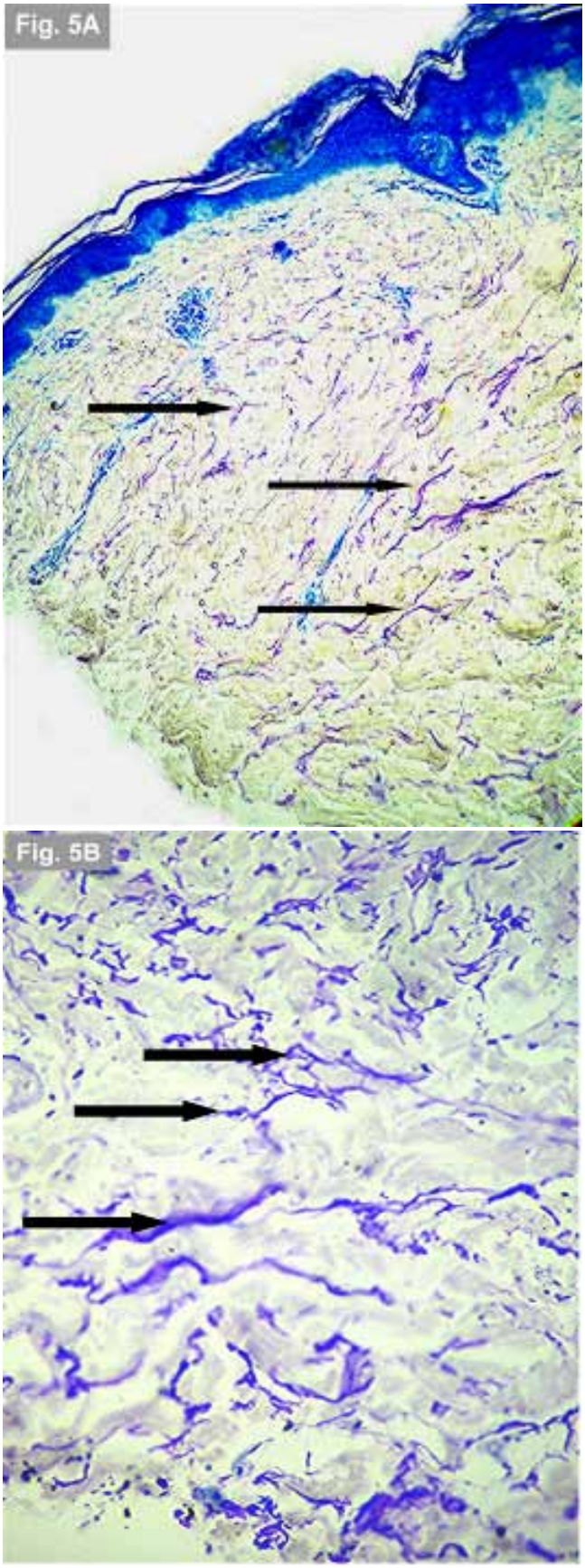
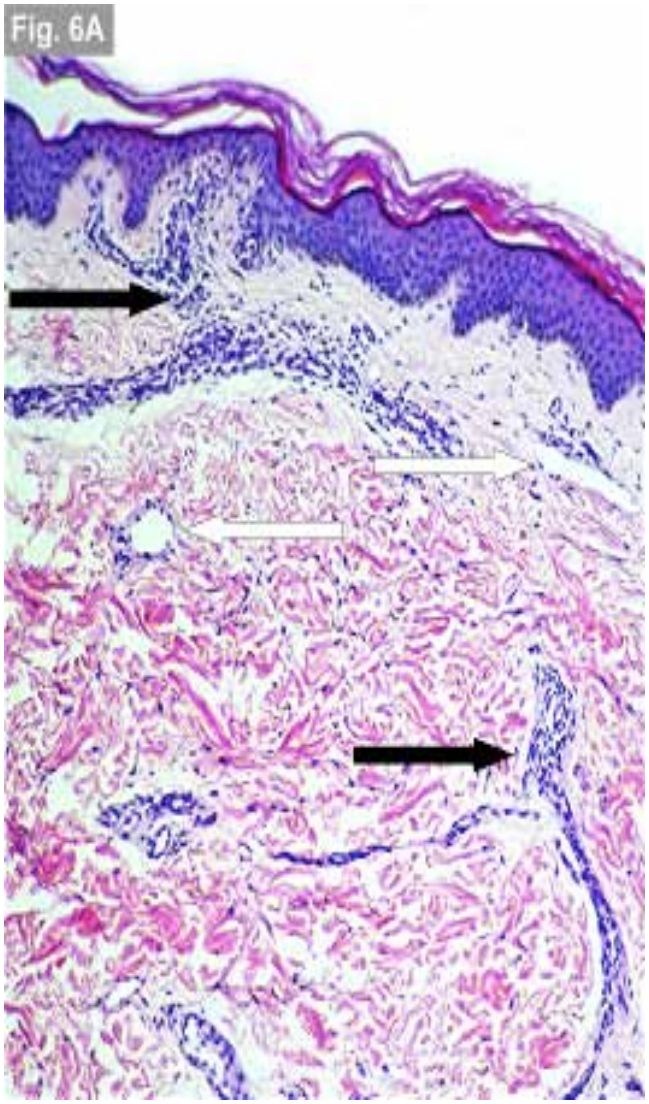


Figure 5. (a) A photomicrograph of the skin section of group I demonstrating elastic fibers of the deep reticular dermis formed of thick, long, wavy, and branched elastic fibers (black arrows). (b) A photomicrograph of the skin section of group I demonstrating elastic fibers of the reticular dermis formed of thick, long, wavy, and branched elastic fiber (black arrows).
Aldehyde fuchsin stain, (a) × 100; (b) × 200.



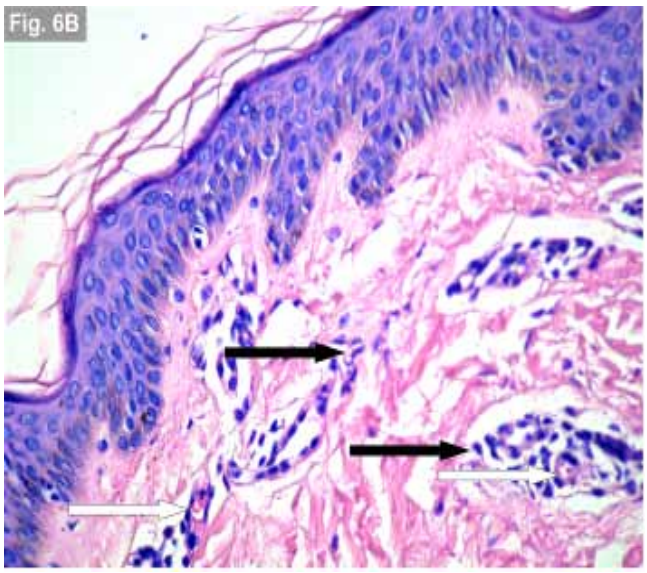


Figure 6. (a) A photomicrograph of the skin section of group II showing increased number and size of subpapillary capillaries (white arrows), with perivascular inflammatory infiltrate (black arrows). (b) A photomicrograph of the skin section of group II showing increased number and size of subpapillary capillaries, which are congested (white arrows), with perivascular inflammatory infiltrate (black arrows). No apparent change in the epidermis is noticed when compared with group I.

H&E stain, (a) × 100; (b) × 200.

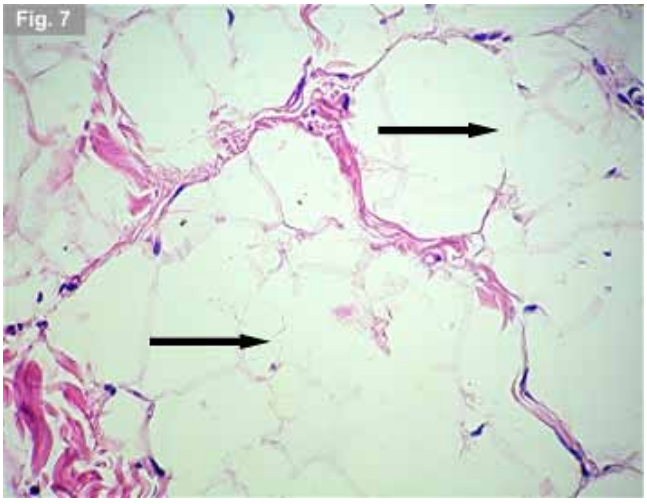
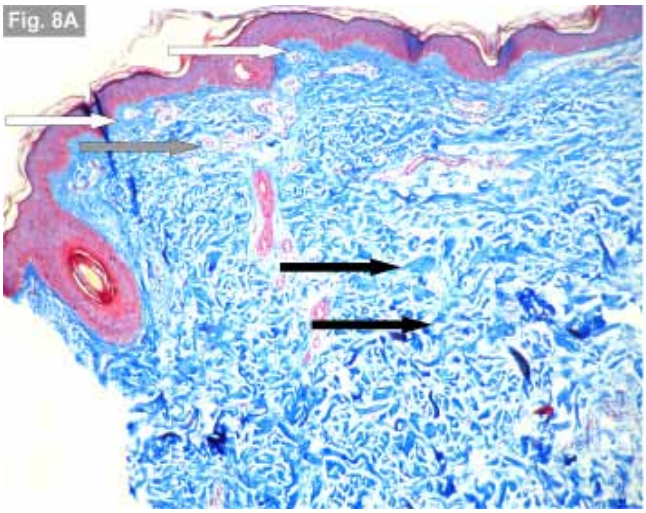


Figure 7. A photomicrograph of the subcutaneous fat of group II showing destruction and distortion of the wall of fat cells (black arrows).

H&E stain, × 720.



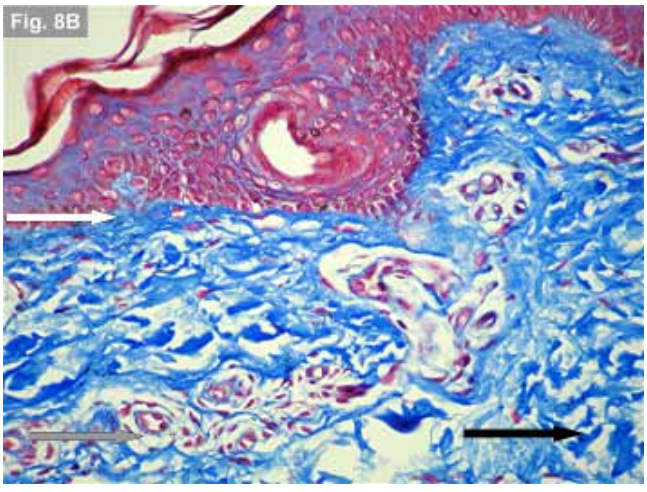
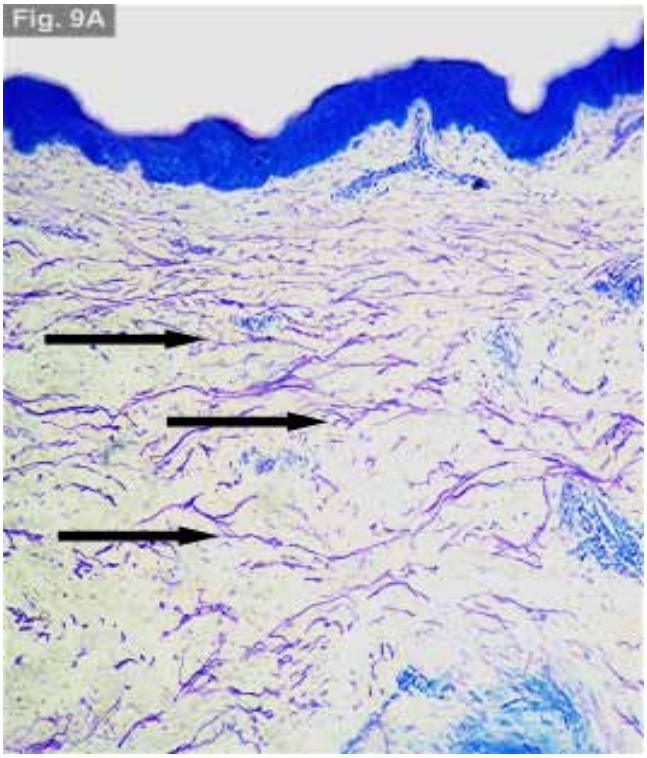


Figure 8. (a) A photomicrograph of skin section of group II showing thin papillary collagen fibers (white arrows) and irregular coarse collagen bundles in the reticular dermis (black arrows). Note increased subpapillary vascular plexus with perivascular infiltrate (gray arrow). (b) Higher magnification of the skin section of group II showing a part of the previous section. Thin dense papillary collagen fibers (white arrow), coarse irregular collagen bundles of the reticular dermis (black arrow), and increased subpapillary vascular plexus with perivascular infiltrate (gray arrow) are noted.

Masson's trichrome stain, (a) × 100; (b) × 200.



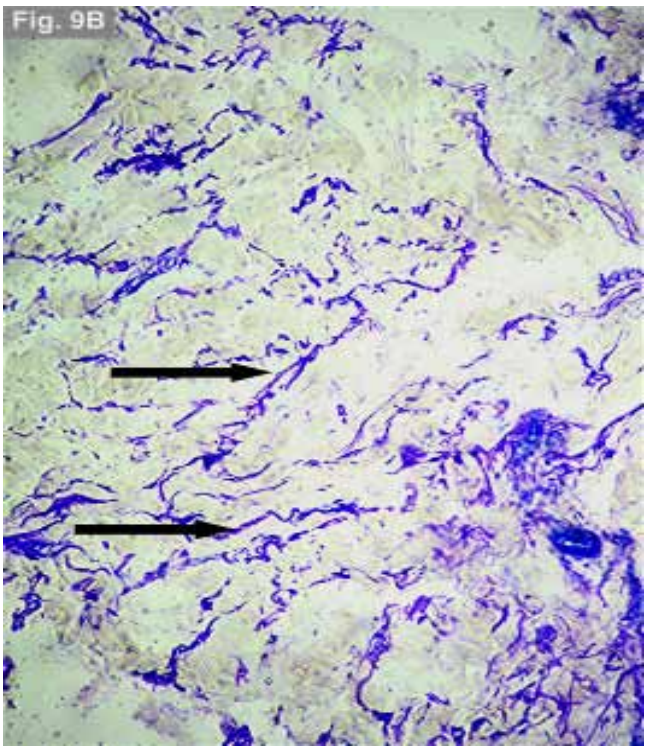
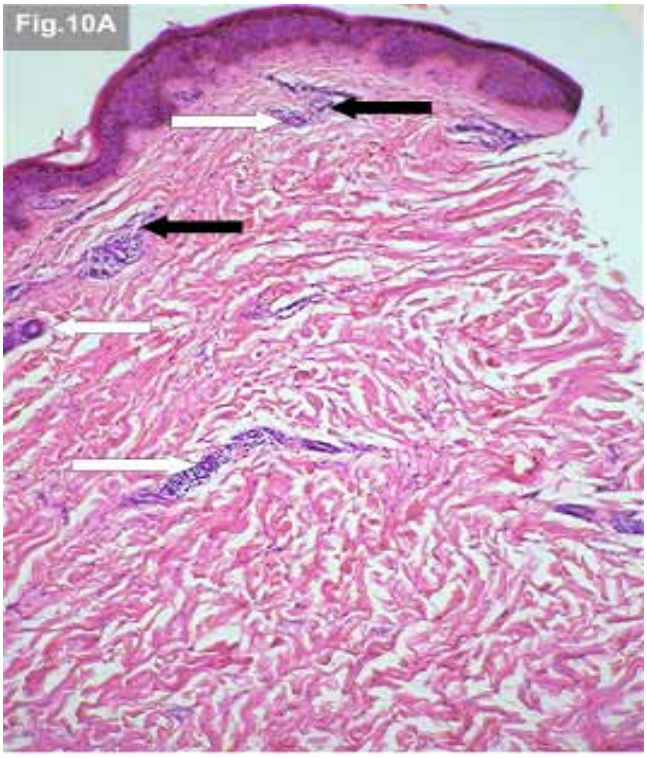


Figure 9. (a) A photomicrograph of skin section of group II showing elastic fibers of the reticular dermis which appeared thick, more tortuous, and more branching when compared with group I. (b) A photomicrograph of skin section of group II showing elastic fibers of the reticular dermis which appeared thick, more tortuous, and more branching (black arrows) when compared to group I.
Aldehyde fuchsin stain, (a) × 100; (b) × 200.



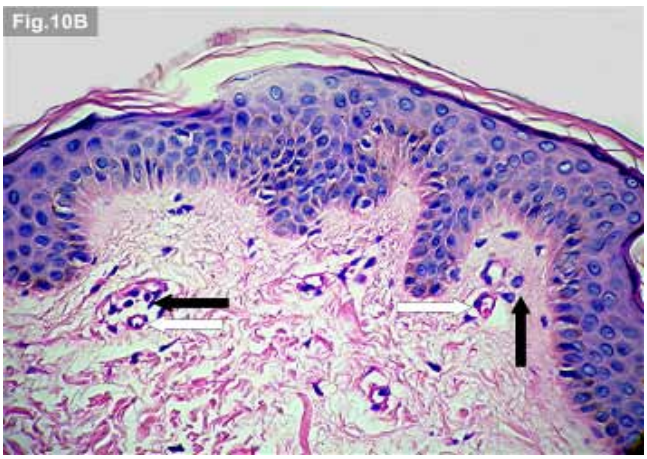


Figure 10. (a) Photomicrograph of a skin section of group III showing mild inflammatory infiltrate of the dermis (black arrows) and mild vascular proliferation (white arrows). (b) Photomicrograph of skin section of group III showing mild inflammatory infiltrate of the dermis (black arrows) and mild vascular proliferation (white arrows).
H&E stain, (a) × 100; (b) × 200.

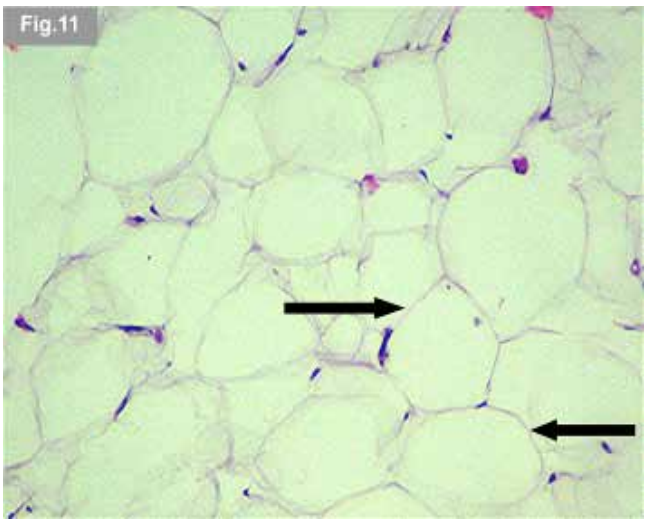


Figure 11. A photomicrograph of subcutaneous fat from group III showing reappearance of intact fat cells with signet ring appearance (black arrows).
H&E stain, × 720.

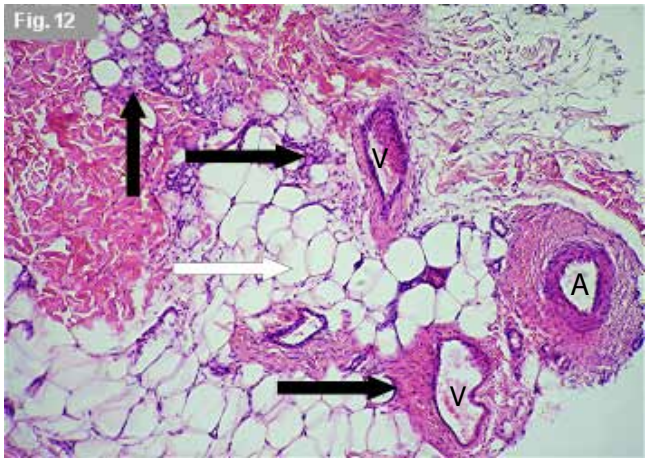
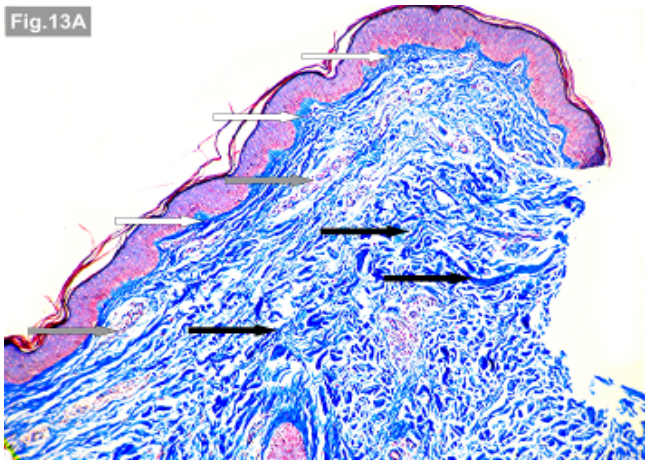


Figure 12. A photomicrograph of a section of the deep dermis and hypodermis of only one patient of group III showing an intense inflammatory infiltrate at the dermal–subcutaneous interface and in the adipose tissue. Inflammatory infiltrates (Black arrows) outlined the individual adipocytes (white arrow) giving a lacy pattern. In addition, vascular proliferation consisting of an artery (A) and veins (V) are noted.

H&E stain, × 200.



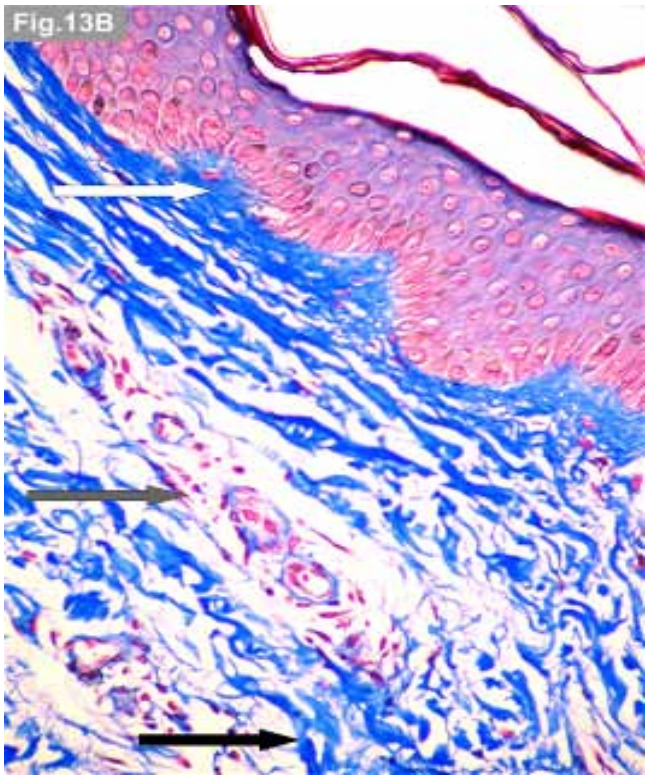
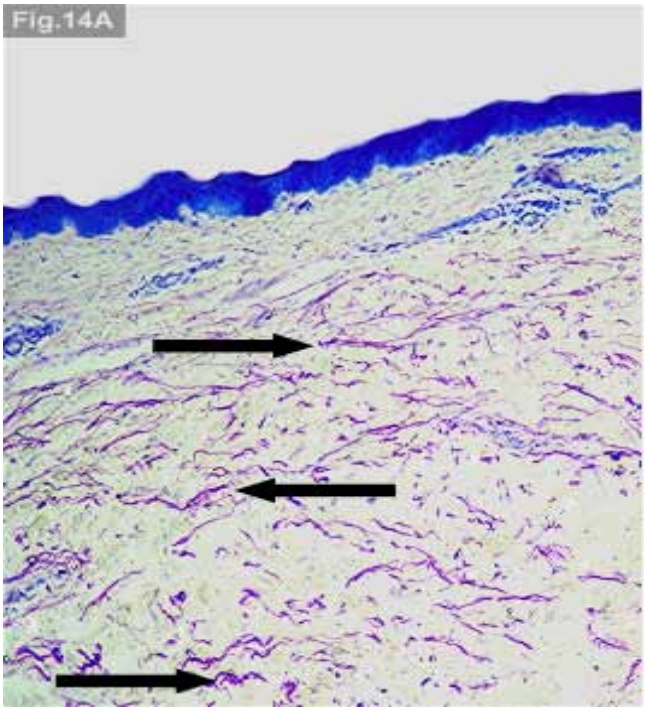


Figure 13. (a) A photomicrograph of a skin section of group III showing fine dense subepidermal collagen fibers (white arrows), thick, wavy, interlacing collagen bundles of the reticular dermis (black arrows), and subpapillary vascular proliferation and infiltration (gray arrows). (b) A photomicrograph of the skin section of group III showing fine dense subepidermal CT (white arrow) and thick, wavy, interlacing collagen bundles of the reticular dermis (black arrow). Note increased subpapillary vascular proliferation and infiltration when compared with group I (gray arrow).

Masson's trichrome stain, (a) × 100; (b) × 200.



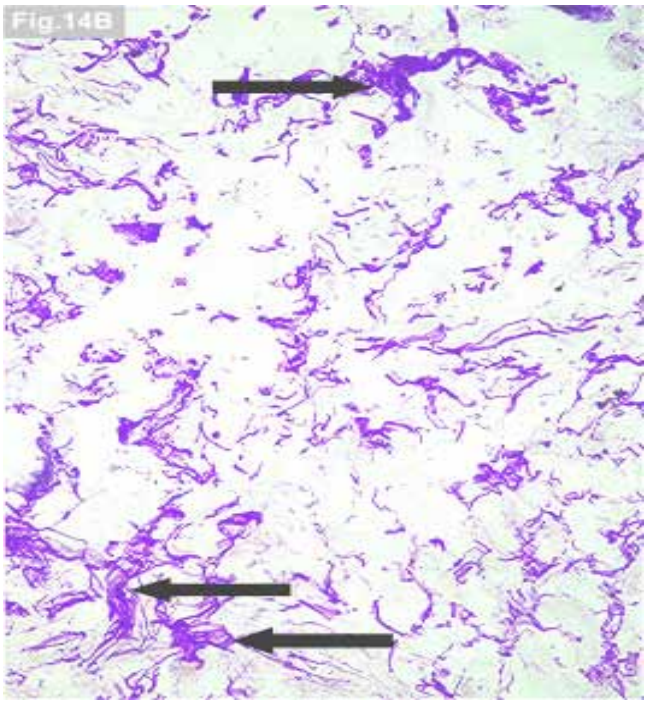


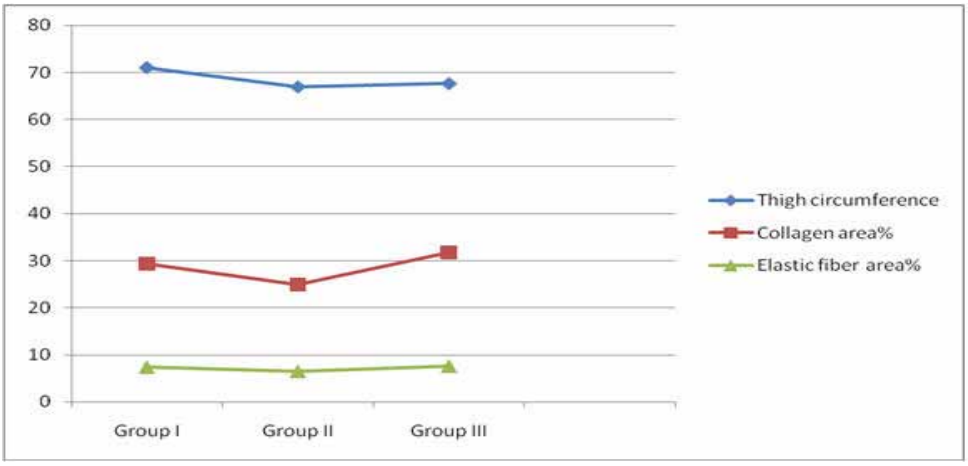
Figure 14. (a) A photomicrograph of a skin section from group III showing abnormally thick, tortuous elastic fibers of the reticular dermis in this group when compared with group I (black arrows). (b) A photomicrograph of a skin section from group III showing abnormally tangled and amorphous elastic fibers of the reticular dermis in this group (black arrows) when compared with group I.

Aldehyde fuchsin, (a) × 100; (b) × 200.

Table 1. Comparing study parameters change throughout the study, using Friedman's test

Parameters	Groups	Mean ± SD	χ^2	*P*
Circumference of the thigh at the injected area	I	71.0 ± 4.3	6.125	0.047*,a
	II	66.9 ± 4.6		
	III	67.6 ± 4.3		
Collagen fibers area% change	I	29.4 ± 10.5	7.400	0.025*,b
	II	24.9 ± 9.5		
	III	31.8 ± 9.7		
Elastic fibers area% change	I	7.4 ± 2.0	3.800	0.150
	II	6.5 ± 1.9		
	III	7.6 ± 2.9		

[a]Significant overall changes of thigh circumference by the end of the study.
[b]Significant overall changes of collagen fiber area% by the end of the study.
*$P<0.05$, significant.



Histogram 1. A histogram illustrating the mean changes in thigh circumference at the injected area (blue line), in collagen fiber area% (red line), and in elastic fiber area% (green line) in groups I, II, and III throughout the study.

Discussion

The field of nonsurgical lipolysis has grown enormously in the past few years, as several techniques have been proposed as alternative techniques to liposuction and its harmful complications, especially for resistant localized fat deposits not removed by strict diet or exercise [9]. The most simple and economic one is the use of subcutaneous injections of active principles able to achieve local fat reduction through chemical lipolysis [10].

In the present study, metric measurements revealed a statistically significant decrease in the thigh circumference crossing the injected area in our patients at the end of the study. However, the more striking effect was that there was no laxity of skin in the injected areas of all patients. The skin looked tight and felt leathery. In accordance with the results of this study, other authors also noted visible firmness and localized skin retraction in patients with skin laxity and marked reduction in diameter at the injection site of PPC [6,11]. Moreover, multiple clinical trials supported the idea that subcutaneously injected PPC leads to a reduction in the volume of adipose tissue [3,4], most probably because of its known lipid-lowering effect in serum after parenteral administration [12,13]. The proposed mechanisms of action of PPC include emulsification and transport of triglycerides from fat cells, detergent action that acts to open cell membranes, and stimulation of lipase enzyme activity [14].

One month after treatment, the skin showed increased number and size of subepidermal capillaries, which were congested and had perivascular and periappendageal inflammatory infiltrate. These results have been reported by other authors who also performed a histologic study of fat injected with a PPC formula. They recorded mixed cellular infiltrate, foam-laden macrophages, and multinucleated giant cells in fat 1 and 2 weeks after injection [15]. It was also reported that injection lipolysis with PPC causes tissue fibrosis and necrosis of adipose and vascular tissues [5]. Two months after injection, the dermis showed milder vascular and inflammatory reactions than those found 1 month after injection.

With regard to subcutaneous fat, in the present study, most of the cases showed destruction of fat cells in the hypodermis. These histological changes were in accordance with another study in which microscopic examination of the treated specimens was performed 1 month after injection and showed fat cell-wall disruption, focal inflammation, and strands of collagen deposition aligned with a palisade of fat cells [11]. However, 2 months after injection, the fat cells started to regenerate in most of the cases, explaining the partial rebound effect. This is most probably because of regeneration of fat cells from stem cells present in subcutaneous tissue called adipose-derived stem cells. Adipose-derived stem cells constitute a stem cell population within the adipose

tissue that is responsible for replacing mature adipocytes throughout the lifetime of the individual [16].

With regard to dermal collagen fibers, the morphometric and statistical analysis for area percentage of collagen showed that there was a reduction in area% of collagen in most of the specimens taken after 1 month. This decrease may be because of the protease enzymes derived from inflammatory cells, such as collagenase enzyme of neutrophils [17]. After inflammation subsidence and reduction of inflammatory infiltrate, the degradation of collagen fibers decreased and they started to increase again as shown in the specimens taken after 2 months. These changes were statistically significant with regard to collagen deposition, which is likely to be the cause of skin tightening [18,19] observed clinically at the end of the study.

Parallel changes occurred in the elastic fiber area%, which first decreased 1 month after injection and then started to increase. However, this increase in elastic fibers was not statistically significant possibly because of the small sample size. In addition, elastic fibers underwent evident morphological changes 2 months after injection. They appeared thicker when compared with those of group I and II with abnormal tangled amorphous elastic material. It has been found that induction of an inflammation process inside the deeper dermis followed by recovery of inflammation leads to the creation of new collagen and elastic fibers and consequently tissue tightening [20].

Thus, Injection lypolysis not only resulted in lipolytic effect on hypodermis but also induced inflammation-regeneration-rejuvenation on the entire layers of the skin. Owing to the fact that collagen forms the bulk of the dermis, providing both strength and elasticity, and elastic fibers are responsible for returning the skin to its normal configuration after being deformed [11,14], both contributed to the regenerating effect and the leathery tight skin texture found at the end of the study.

Conclusion

In conclusion, a single-session PPC injection for localized fat deposits had an evident lipolytic effect, with noticeable contouring due to a regeneration influence on dermal collagen and, to lesser extent, on elastic fibers, leading to skin tightening. This dual effect was very important as reduction of fat only leaves ugly redundant skin that may need resection. However, the lipolytic effect is partially temporary because of regeneration of fat cells.

Recommendations

We recommend further studies on larger populations, which can obviate these changes.

Histological study of the effect of smaller doses of PPC injection with minimal vascular and inflammatory responses can be conducted.

It is also recommended to follow-up after PPC injection by histological assessment to find out the timing of disappearance of inflammatory responses, and hence proper spacing of sessions.

Further long-term studies are needed for determination of the number of lipolysis injection sessions required for sustained and further sculpting effect.

Acknowledgements

Conflicts of interest

There is no conflict of interest to declare.

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الملخص العربى

تأثير حقن مادة الفوسفاتديل كولين تحت الجلد المستخدم فى علاج السمنة الموضعية على البنيه النسيجية للجلد و النسيج التحت جلدى فى الانسان : دراسة إرشادية

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المقدمة: أيدت عدة محاولات إكلينيكية فكرة حقن الفوسفاتديل كولين تحت الجلد لإذابة التركمات الدهنية الموضعية. و لكن كان هناك عدد قليل من الدراسات الهستولوجية التى أوضحت طريقة عمل الفوسفاتديل كولين.

الهدف من البحث: الهدف من هذه الدراسة هو تقييم التغيرات الاكلينيكية و الهيستولوجية الدقيقة التى تحدث فى الجلد و النسيج التحتى له بعد حقن الفوسفاتديل كولين .

الطريقة: أجريت هذه الدراسة على عشرة سيدات يعانين من تراكمات دهنية موضعية فى أعلى الفخدين و قد تم حقن مادة الفوسفاتديل كولين فى هذه المنطقة خلال جلسة واحدة فقط ثم أجرى تقييم بقياس محيط أعلى الفخدين كما أجريت دراسة هيستولوجية لعينات أخذت من منطقة الحقن قبل حقنها مباشرة و بعد شهر و شهرين من حقنها بمادة الفوسفاتديل كولين. تم صباغة الشرائح الهيستولوجية بصبغة الهيماتوكسلين و اليوسين و كذللك صبغتها بصبغ الميسون ترايكروم (لدراسة الليلياف الكولاجين) و صبغتها بصبغة الالدهيد فوكسين (لدراسة الليلياف الايلاستين) ثم تم عمل قياسات شكلية لهم ودراسة إحصائية للنتائج.

النتائج: من الناحية الاكلينيكية وجد أن حقن مادة الفوسفاتديل كولين أدى الى تناقص فى محيط المنطقة الفخدية المحقونة ذو دلاله إحصائية عند مقارنتة قبل الحقن و بعد الحقن بشهرين، كما وجد أن الجلد فى هذه المنطقة قد بدا مشدودا غير مترهل.

من الناحية الهستولوجية وجد أن حقن مادة الفوسفاتديل كولين قد صاحبها ظهور التهاب و زيادة فى الاوعية الدمويه الدقيقة و تهتك فى جدان الخلايا الدهنية الموجودة تحت الجلد بعد شهر من الحقن ثم قل الالتهاب بعد شهرين من حقن العقار و بدأت الخلايا الدهنية فى الظهور مرة أخرى. وسجلت أيضا زيادة ذات دلالة إحصائية بالنسبة لالياف الكولاجين فى نهاية الدراستو كذلك سجلت زيادة فى بالنسبة لالياف الايلاستين و لكنها لم تكن ذات دلالة إحصائية.

الخلاصة: أثبتت هذه الدراسة أن حقن مادة الفوسفاتديل كولين تحت الجلد كان لها تأثير فعال فى إذابة الدهون مع شد واضح للجلد نتيجة تأثيرها على النسيج الضام للجلد و خاصة على الليلياف الكولاجين فيه. و لكن وجد أيضا أن تأثيرها فى إذابة الدهون كان مؤقتا و جزئيا و ذلك لظهور الخلايا الدهنية مرة أخرى.