Plasma Exeresis Treatment for Epidermoid Cysts: A Minimal Scarring Technique

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BACKGROUND Epidermoid cysts are cutaneous benign tumors commonly seen in young or middle-aged adults. Plasma exeresis is an innovative technique for several skin conditions: it causes ionization of the atmospheric gas between the proximal tip of the device and the tissue to be treated, creating sublimation of the tissue.

OBJECTIVE To remove the cyst with a novel technique that allows a good cosmetic result.

MATERIALS AND METHODS Patients with clinical diagnosis of at least one epidermal cyst, aged between 18 and 70 years were enrolled. A standardized procedure was used. After administration of topical and sometimes local anesthesia (for cysts bigger than 1 cm), a tiny hole was created with plasma exeresis. The content of the cyst was then extruded and Micro Hartman Alligator Ear Forceps pulled out the loosened capsule.

RESULTS Twenty patients aged between 18 and 68 years were enrolled: 11 males (55%) and 9 females (45%). Twenty-eight cysts were successfully removed. The diameter ranged from 3 to 24 mm. No side effects were observed. The scar measured not more than 3 mm.

CONCLUSION This study suggests that plasma exeresis could represent a good and safe option to remove noninfected cysts on cosmetic areas, although further study is required.

The authors have indicated no significant interest with commercial supporters. Written informed consent was obtained from the patients for publication of this manuscript and accompanying images. A copy of these written consents is available for review from the journal's Editor-in-Chief. All authors made substantive intellectual contributions to the published study and each author listed on the manuscript has seen and approved the submission of the manuscript.

Epidermoid cysts, also called improperly "sebaceous cysts," are cutaneous benign tumors commonly seen in young or middle-aged adults.[1] They can occur anywhere on the body, but they are most commonly seen on the head, neck, chest, and upper back.[2] The diagnosis is often made on a clinical basis: cysts generally appear as subcutaneous nodules variable in size, of a firm consistency, covered by smooth normal-colored skin with a central punctum. The size ranges from a few millimeters to several centimeters in diameter.[3] Lesions may remain stable or progressively enlarge. Spontaneous inflammation and rupture can occur, with significant involvement of surrounding tissue.[4]

The cyst wall consists of normal stratified squamous epithelium derived from the follicular infundibulum. The cavity is filled with laminated layers of keratinous material. Epidermal inclusion cysts are often removed just for cosmetic reasons.[5]

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Different techniques for removing cysts have been described in the literature: elliptical incision, punch incision,[4,6] different laser treatments,[7–9] and minimal incision with chemical cauterization.[10]

Plasma exeresis is an evolving technique for minimally invasive treatment of several skin conditions.[11–15] The medical device ionizes gas present in the spatial gap between the proximal tip of the instrument and the tissue to be treated (Figure 1). Plasma is generated through the tip of the device, in the form of an ultra-gas-like state of matter, and the energy created is transferred onto the superficial skin layer. This energy, as a difference in voltage, is delivered to electrons, protons, and neutrons contained in the air, leading to excitation of the electrons in the external shield. The tissue is sublimed: a direct transition of the tissue from a solid phase to a gaseous state is created, preventing the transfer of heat to the surrounding tissues.[16]

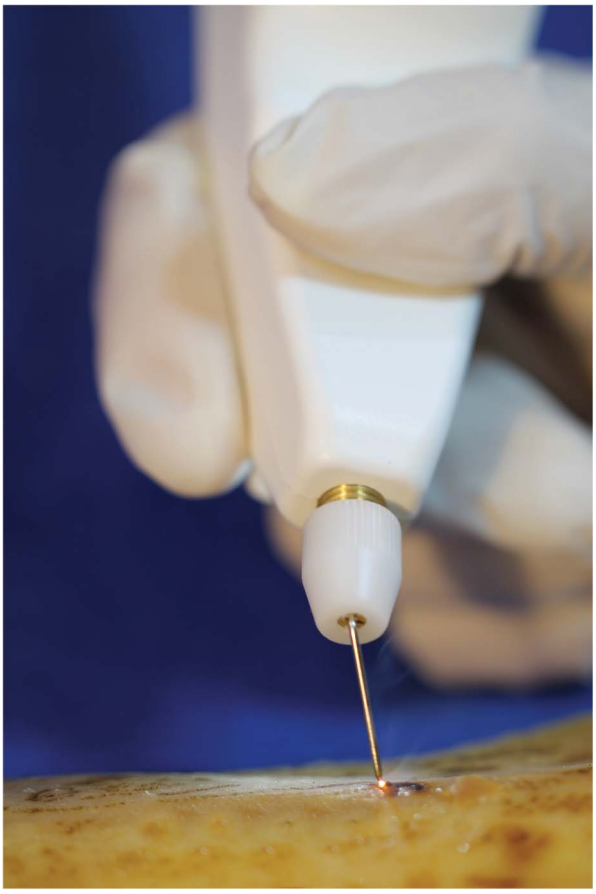

Figure 1. The medical device generates the plasma through the tip of the device in the form of an ultra-gas-like state of matter, and the energy created is transferred onto the superficial skin layer.

There is no contact between the (disposable) tip and the skin. The device generates a controlled and focused microplasma beam, with a highly selective pattern in terms of frequencies and timing. The device has 3 different handpieces, generating signals with equivalent frequency (75 kHz) and different power. The handpiece needs to be chosen in relation to the type of treatment: the lower one is white (0.7 W), the medium one is green (1 W), and the higher one is red (2 W). When using plasma exeresis, we can use 2 different techniques: spot and spray.[11–15]

Spray mode is an ablative technique for lesion removal, whereas a spot technique (with spots never lasting more than 2 seconds) is used for the non-ablative treatment of cutaneous laxities.[11–15]

The aim of the authors' study is to investigate the effectiveness of the spray technique of plasma exeresis in removing epidermal cysts (in the absence of signs of infection).

Materials and Methods

Patients

Patients referring to a private dermatologic center in Modena for suspicious epidermal cyst removal from June 2013 to January 2017 were recruited. All eligible patients identified by the researchers during the study registration period were included (consecutive case series). This observational, retrospective study was conducted according to the principles of Declaration of Helsinki.

Inclusion criteria were: patients with clinical diagnoses of at least one epidermal cyst from 3 mm to 25 mm and age between 18 and 70 years.

Exclusion criteria were: previous hypertrophic scars, surgical or laser treatment of the area, or oral retinoid drug prescribed within the past 6 months. Infected or inflamed cysts, recurrent cysts, and those with uncertain diagnosis were also excluded from the study.

All patients provided informed written consent.

Operative Technique

The same dermatologist (E.R.) administered all the treatments in a private practice office.

(1) A standardized procedure was performed for each lesion as follows: After gentle cleaning of the tissue to be treated, the authors measured the lesion and applied a galenic anesthetic cream (20% lidocaine, 5% tetracaine, and 5% prilocaine in base cream), which was left to rest for 30 minutes with occlusive medication.
(2) The area was then cleared and disinfected with a nonalcoholic solution (Figure 2A).
(3) Local anesthesia was necessary only for lesions larger than 10 mm; in those cases, small amounts (0.1–0.2 mL) of 1% xylocaine were injected. The plasma exeresis handpiece created a 1 to 3 mm hole on the top of the cyst (Figure 2B). Plasma exeresis was performed with Plexr (GMV, Rome, Italy). The type of handpiece used depended on the anatomical area and the thickness of the skin overlying the cyst.
(4) Contents of the cyst were extruded by applying uniform, centripetal pressure around the cyst using fingertips and gauze (Figure 2C).
(5) After expulsion of the cyst contents, a Micro Hartman Alligator Ear Forceps was inserted into the hole to grab the capsule; the loosened capsule was first clamped and then extruded (Figure 2D).
(6) Once the procedure was completed, the authors disinfected the area; in case of bleeding, manual compression was performed for 10 minutes. No medications were applied.

Patients received written indications for post-treatment care: wash the area with neutral soap, disinfect twice a day until scabs spontaneously fall off, avoid early removal of the scabs, and sun exposure for at least 1 month. For face cysts, the application of hypoallergenic fluid foundation was advised.

Follow-up visits were scheduled 30 to 90 days after the treatment; the scar, if present, was measured. When recurrence was reported in person by the patient, it was recorded by the dermatologist.

Images

Photographic images were taken before the procedure (T0A), immediately after the treatment (T0B), and 4 to 12 weeks after cyst removal (T1) (Figure 3). Clinical images were collected by using an 8-megapixel iSight camera with 1.5 μm pixels and an f/2.2 aperture.

Results

Between June 2013 and January 2017, 20 patients aged between 18 and 68 years (mean 41.7, median 39.5) were enrolled: 11 males (55%) and 9 females (45%). Four patients had multiple cysts. Twenty-eight

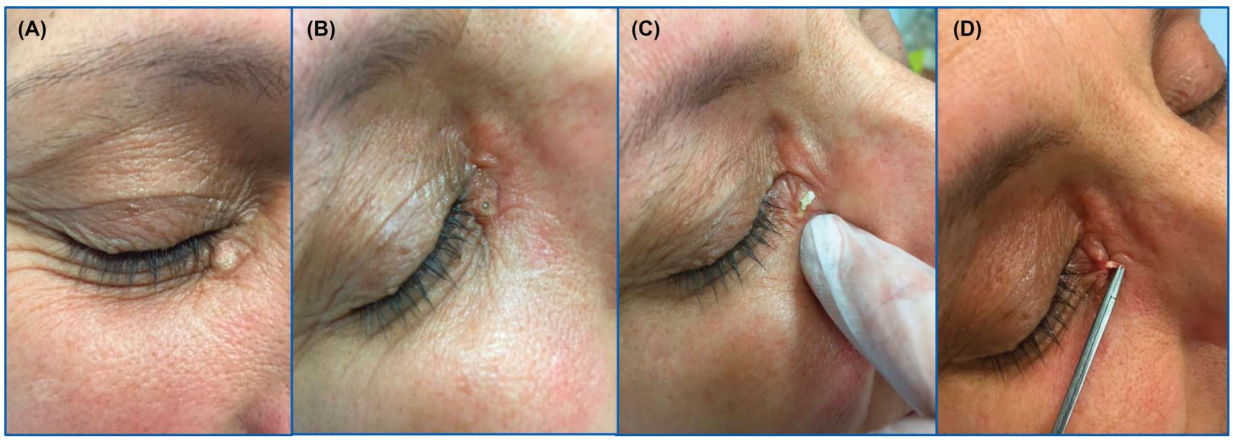

Figure 2. Operative technique: after the occlusion with topical anesthetic cream, the area is revealed (A). A tiny hole is performed on the top of the cyst (B). The content of the cyst is gently extruded through the hole (C). Then, the loosened capsule is removed using Micro Hartman Alligator Ear Forceps (D).

Figure 3. Clinical images of patients were acquired before the procedure (T0A), immediately after the treatment (T0B), and 4 to 12 weeks after cyst removal (T1). Patient 14 removed also some cyst smaller than 3 mm that were not included in the study. At T1, for patients 14 and 19, the authors do not appreciate any scars, patient 3 had a small scar (1 mm) less noticeable than the chicken-pox scar located more laterally, and patient 17 removed a 2-cm cyst and the resulting scar is 3 mm.

cysts were removed. The diameter ranged from 3 to 24 mm (mean 8.9, median 6.5). All the data are shown in Table 1.

Twenty-two lesions were on the head (19 on the face and 3 on the scalp), 1 on the neck and 5 on the trunk (3 on the chest and 2 on the back). Only 8 cases required local anesthesia (cysts bigger than 10 mm), whereas all the other cases only received topical anesthesia.

Eight lesions were on the eyelids, which in the authors' case series was the most frequent area of the head (36%) and of the face (42%), and represented 28% of the whole number of cysts.

Table 1. Clinical Characteristics of Patients Included in the Study, Characteristics of Cysts, Type of Treatment, and Follow-up

No	*Photograph type*	*Sex: F = female; M = Male*	*Age, years*	*Size, mm*	*No. of lesions*	*Area*	*Type of Anesthesia: T = topical; L = local*	*Handpiece*	*Time Fup, months*	*Scar*
1	I	F	51	5	1	Upper eyelid	T	Green	20	No
2	II	M	18	7	1	Chest right	T	Red	4	2 mm
3	II	M	30	10	1	Temple	T	Green	5	1 mm
4	II	F	63	13	1	Breast	L	Red	5	2 mm
5	III	F	20	3	1	Forehead	T	White	5	1 mm
6	III	F	47	15	1	Scalp	L	Red	6	No
7	II	M	57	20	1	Scalp	L	Red	6	2 mm
8	IV	F	31	5	1	Cheek	T	Green	8	1 mm
9	IV	M	26	8	1	Chest	T	Green	8	1 mm
10	II	M	45	23	1	Neck	L	Red	18	3 mm
11	III	F	53	1 × 7 mm; 1 × 3 mm	2	Lower eyelid	T	White	20	No; No
12	II	M	34	8	1	Preauricular	T	Red	17	2 mm
13	III	M	27	4	1	Forehead	T	Green	41	No
14	II	M	28	1 × 6 mm; 3 × 3 mm	4	Posterior Ear	T	Green	6	No; No
15	II	M	67	24	1	Cheek	L	Red	7	3 mm
16	III	M	65	1 × 6 mm; 1 × 4 mm; 2 × 3 mm	4	Lower eyelid	T	White	8	No
17	II	F	68	20	1	Preauricular	L	Red	7	3 mm
18	II	M	18	1 × 6 mm; 1 × 8 mm	2	Back	L	Green	38	1 mm; 1 mm
19	III	F	56	7	1	Lower eyelid	T	White	5	No
20	II	F	30	23	1	Scalp	L	Red	4	2 mm

Fup, follow-up.

The choice of handpiece for the 28 cysts turned out to be: the lower handpiece for 8 lesions, the medium for 11, and the harder for 9.

Crusts deriving from the sublimation process lasted from 3 to 5 days up to 7 to 14 days, depending on the depth of the cyst. As the superficial crusts fell off, the skin surface was slightly erythematous. Cutaneous erythema was transient and lasted for a variable amount of time, from 20 to 45 days. No erythema was recorded at T1. No wound infection, ecchymosis, edema, postinflammatory hyperpigmentation, hypopigmentation, or keloid were observed in the treated area.

The scar, if present, measured no more than 3 mm (mean 0.5, median 0.9). The authors could not notice any scars in 14 cysts (50%). All the lesions were successfully treated and during the follow-up time, no recurrence occurred. The follow-up time ranged between 4 and 41 months (mean 11.9, median 7).

Discussion

Epidermoid cysts are common and benign skin tumors, which may grow anywhere on the body. Although it is reported in the literature that epidermal cysts of the head and neck constitute only about 7%,[17] in the authors' case series, 86% of the lesions were located in this area. This is probably because the selected patients wish to remove cysts in highly cosmetic areas such as the face. Conventional management of these lesions involves a surgical procedure with which scarring is unavoidable.[3–10] The procedure can often be performed with just the application of anesthetic cream for lesions up to 1 cm (71% in the authors' study) or with minimal amount of local anesthesia (29%) for cysts from 1 to 2.4 cm. When compared with traditional incision, plasma exeresis has several advantages. First, there is no need to use blades, foreceps, and needle holders. Only the Plexr device and the Micro Hartman Alligator Ear Forceps are necessary. Moreover, suturing is never required. Last but not least, there is no need to use surgical tape (often applied after minimal surgical procedures). This can be very useful for cysts on eyelids or on the scalp (where tape can accidentally cause hair removal).

Plasma exeresis on the eyelids does not need eye shields, as there are no potential risks for the patients' vision because the energy is absorbed only by the tissue to be treated, and is not transferred to the surrounding tissue or to the subcutis. The mechanism of action does not imply any absolute contraindications.[11–16] However, an accurate anamnesis is mandatory before starting the treatment.

The choice of the handpiece depends on skin thickness of the anatomical area to be treated,[18] as well as on the depth and dimension of the cyst. Cysts located on the eyelid are usually quite superficial; so, in 7 of the 8 cases, the lower handpiece was used. Lesions on the scalp or on the trunk required the higher handpiece. In areas of average skin thickness such as temple, cheek, or ear, the medium handpiece was chosen.

The tiny hole on the top of the cyst (1–3 mm diameter) does not require placing any superficial sutures. This allows for lack of visible puncture marks, lower tissue reactivity, decreased risk of tissue strangulation, and needlestick injuries.[19,20] The procedure is fast and quite easy to perform, although plasma exeresis is strictly operator-dependent. There are no prefixed parameters and expertise is important in the choice of the spot disposition, in the timing of the spot generation, and in the careful removal of the capsule of the cyst.

The Micro Hartman Alligator Ear Forceps, also called "crocodile forceps," is a medical forceps for removing foreign bodies; only the top mouth opens alligator-like. It is easily inserted (closed position) inside the 1 to 3 mm hole performed with plasma exeresis. Once inside, the alligator mouth opens, grabs the loosened capsule, and pulls it out, thereby minimizing its fragmentation.

Post-treatment crusts are highly acceptable. On the face, fluid foundation can be applied directly on the scab to camouflage it. The resulting scar is very small. At T1 it was not visible in 14 cysts (50%), and the 2 bigger cysts of 23 and 24 mm had 3-mm scars.

The key advantages of this technique include the lack of absolute contraindications, minimal intraoperative

pain, quick treatment, fast post-operative recovery, and a good cost-effectiveness ratio.[11–15]

Conclusions

In the authors' experience, plasma exeresis is a very useful technique not only for the rapidity of execution, but also for the favorable cost-benefit ratio of the instrument, the absence of downtime for the patient, and the minimal scars resulting from the treatment. This study suggests that plasma exeresis could represent a good and safe option to remove non-infected cysts up to 2.4 cm, especially on highly cosmetic areas, although further study is still required.

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