American Journal of Ophthalmology Case Reports 36 (2024) 102159

Contents lists available at ScienceDirect

American Journal of Ophthalmology Case Reports

journal homepage: www.ajocasereports.com/

Traumatic vitreous hemorrhage and choroidal rupture after needleless Dermojet injection to the eyebrow

Hend Alsafran [a], Ali Esmaeil [a,*], Alaa AlAli [a,b,c]

[a] Vitreoretinal Service, Department of Ophthalmology, Ibn Sina Hospital, Kuwait City, Kuwait
[b] Pediatric Service, Department of Ophthalmology, Ibn Sina Hospital, Kuwait City, Kuwait
[c] Vitreoretinal Service, Dasman Diabetes Institute, Kuwait City, Kuwait

ARTICLE INFO

Keywords:
Dermojet
Needleless drug delivery
Choroidal rupture
Choroidal neovascularization
Blunt trauma

ABSTRACT

Purpose: In this case report, we discuss a case of ocular insult following a needle-less Dermojet injection to the brow region.

Observations: Initial examination revealed pin-point sites of injector contact over the right brow, a dense temporal subconjunctival hemorrhage, a temporal area of commotio retinae, and a vitreous hemorrhage localized to the inferotemporal quadrant of the retina obscuring the view to the retina behind it. The potential for a concealed penetrating globe injury or retinal break was of significant concern. Conservative management was opted with close follow-up. Over a 10-week period, the patient's symptoms and signs improved, and final assessment showed an extramacular choroidal scar indicative of choroidal rupture. Risks of the development of choroidal neovascularization were communicated and a plan for diligent follow up was given.

Conclusions and importance: We recommend against using high-pressure, needle-less systems in the periorbital area due to vision-threatening risks, urging caution among healthcare professionals.

1. Case report

An 8-year-old girl presented to the emergency department complaining of sudden onset of multiple floaters in the right eye a few minutes after receiving two triamcinolone (2.5mg/ml) applications for right brow alopecia delivered via a Dermojet needle-less injector by her dermatologist. She denied symptoms of pain, flashes, or a field defect, and reported no recent history of trauma. The patient was a known case of Graves' disease with no current or previous history of ocular/orbital involvement. There was no reported past ophthalmic history.

On initial examination in the emergency room, unaided visual acuity was 20/25 in the right eye and 20/20 in the left eye. Inspection revealed 2 pin-point sites of Dermojet injector contact where the steroid was delivered over the right brow area (Fig. 1). Examination of the anterior segment was positive for a dense temporal subconjunctival hemorrhage in the right eye (Fig. 1). In both eyes, the cornea was clear, pupils round, regular, and reactive, anterior chambers deep and quiet, and both lenses clear. Examination of the fundus in the right eye was positive for a vitreous hemorrhage localized to the infero-temporal quadrant of the retina and an area of commotio retinae temporally; retinal status beyond the vitreous hemorrhage could not be elucidated. (Fig. 2). Otherwise, the retina looked flat, and the retinal vasculature, macula, optic disc, and intraocular pressure were within normal.

The patient's condition was discussed with the patient's mother and the possible presence of a penetrating globe injury and retinal break obscured by the vitreous hemorrhage was explained. Close follow-up was arranged to reassess the retina as the vitreous hemorrhage resolves. The patient and mother were counseled about the red flag symptoms of retinal detachment including worsening floaters, photopsia, or a visual field defect. In addition, the need for urgent assessment in the emergency department if any symptoms arise was advised.

The patient was followed up conservatively with appointments initially set on a weekly basis, then bi-weekly as the vitreous hemorrhage resorbed. During follow up, the patient had gradual improvement in floaters with settling of the vitreous hemorrhage inferiorly, and gradual resolution (Figs. 3 and 4). After 2 months of follow up, unaided visual acuity was 20/20 in the right eye with a normal anterior segment. As for the fundus, a choroidal scar consistent with choroidal rupture was observed. No further signs of retinal injury were seen, but a small remnant of vitreous hemorrhage was still present inferiorly. A final diagnosis of posterior segment injury consistent with traumatic vitreous hemorrhage, commotio retinae, and choroidal rupture secondary to

* Corresponding author. Al Bahar Centre, Ibn Sina Hospital, Shuwaikh Medical Area, Kuwait.
E-mail address: ali.moh.esmaeil@gmail.com (A. Esmaeil).

https://doi.org/10.1016/j.ajoc.2024.102159
Received 7 April 2024; Received in revised form 29 June 2024; Accepted 29 August 2024
Available online 6 September 2024

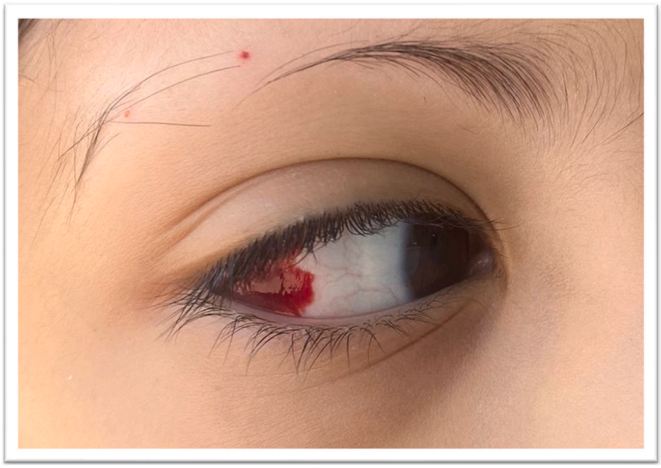

Fig. 1. Few hours after receiving triamcinolone via Dermojet. General exam reveals an area of alopecia with two entry points over the right eyebrow with temporal subconjunctival hemorrhage.

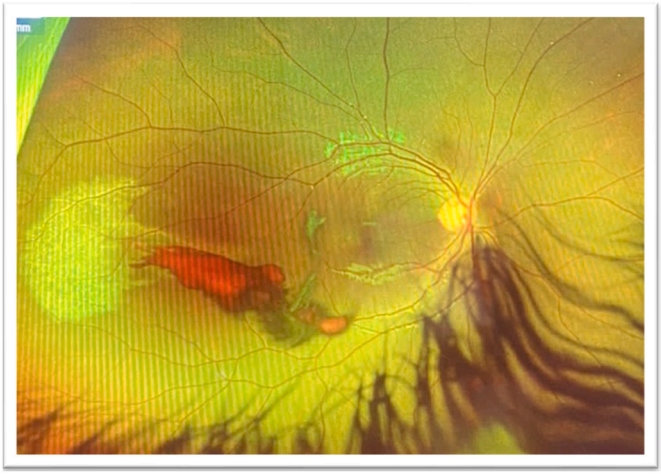

Fig. 2. 20 hours after the injection. Fundus image demonstrating vitreous hemorrhage localized inferotemporally to the macula and an area of commotio retinae temporally.

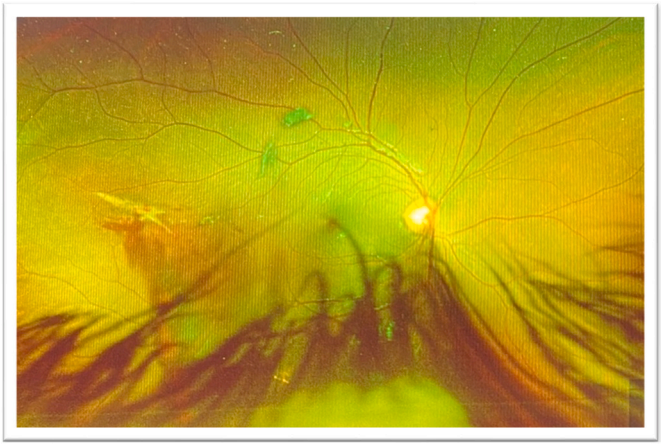

Fig. 3. 10 days after injection. Fundus image demonstrating gradual improvement and settling of the vitreous hemorrhage inferiorly. Whitish/yellowish curvilinear crescentic streak consistent with choroidal rupture is located in the temporal aspect of the retina.

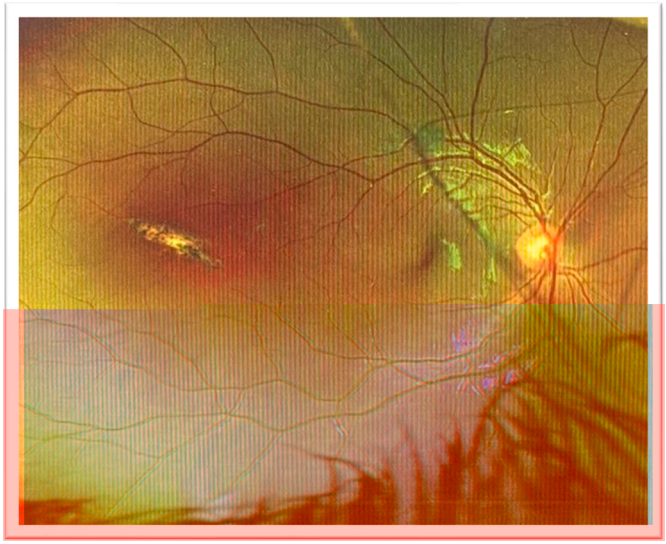

Fig. 4. 10 weeks after injection. Fundus image demonstrating resolution of vitreous hemorrhage. Whitish/yellowish curvilinear crescentic streak consistent with choroidal rupture localized to the temporal quadrant of the retina.

Dermojet injection was made. Risk of development of choroidal neovascular membrane was explained to the patient's parents and longer follow-up intervals were arranged.

2. Discussion

Dermojet is a drug delivery system with a fascinating history and a broad range of utilization in contemporary medicine. Dermojet was envisioned by Dr. A Krantz in the 1960s as an instrument to facilitate painless, needle-free delivery of medication, predominantly steroids, to localized areas of skin and soft tissue.[1] This technology has found applications in various fields, such as dermatology and pain management, among others. In dermatology, it has been used extensively in managing various skin conditions such as keloids, alopecia areata, localized psoriasis, and atrophic scars, due to the ability of the device to effectively deliver medication in a pain-free fashion.[2] The working principle of Dermojet employs a high-pressure jet system that enables it to propel a specific dose of medication directly into the dermis or subcutaneous tissue without the use of a needle. This is achieved by converting the energy in a compressed spring or a pneumatic system into kinetic energy that is concentrated into a fine, high-speed jet of medication capable of breaching the skin barrier[3,4]. The device allows for specifically controlled dosage and depth, making it an efficient and versatile tool for localized drug administration [4].

With the proper precautions and training, Dermojet is generally considered safe. Local reactions can occur at the site of drug administration and are usually restricted to minor swelling and discomfort.[5] Although rare, reports of serious injury to surrounding structures have been relayed in the literature. Most injuries with the use of Dermojet occur due to improper handling or inappropriate use of the device. Examples of significant injuries from injection of triamcinolone acetate via Dermojet include tendon rupture and the development of a granulomatous reaction following treatment to the dorsal aspect of the hand in an effort to treat lichenified eczematous lesions.[6] One of the most critical risks associated with Dermojet injection is ocular injury, including potential eyeball perforation when it is used around the face and eyebrow area. This risk is due to the high pressure by which the medication is delivered, which, if accidently directed towards the eye, could result in traumatic injury. Such an injury has been reported in the case of a 53-year-old man with psoriasis and alopecia areata who received a triamcinolone injection via Dermojet to his right eyebrow; this

subsequently led to acute loss of vision secondary to a perforating eye injury with an associated vitreous hemorrhage and 2 retinal tears. The anterior segment exam was unremarkable except for a pinpoint entry wound on the sclera. After laser intervention to the retina, the patient's best corrected visual acuity was recorded as 6/9 at 10 months.[7] Another case of ocular injury following the use of Dermojet administration of triamcinolone to the right upper lid resulted in an entry wound self sealing perforating wound on anterior segment exam and retinal hemorrhage. The high stream jet had both an entry and exit wound, both closing spontaneously due to their small size but leaving signs/injury behind. This patient was treated with analgesics and mydriatics with visual acuity returning to 20/20 over the course of 1 week.[8] No surgery was required to be performed.

In this case report, our patient presented with traumatic subconjunctival and vitreous hemorrhage, commotio retinae, and choroidal rupture after receiving a Dermojet injection of triamcinolone acetate to her eyebrow. To our knowledge, commotio retinae and choroidal rupture have not been previously reported as complications of this procedure. Both of these retinal injuries are known to occur secondary to significant blunt trauma.

Choroidal rupture is defined as a break in the choroid, Bruch's membrane, and the retinal pigment epithelium (RPE), usually caused by traumatic injury to the globe.[9] Ocular injury leading to choroidal rupture may be, more commonly, blunt or, less commonly, penetrating.[10] In our case report, the mechanism of trauma was most likely blunt, considering the high-pressure jet force mechanism by which the Dermojet drug-delivery system functions, as well as the lack of signs suggestive of a posterior globe penetrating injury, which include a diffuse, dense subconjunctival hemorrhage, an abnormally deep anterior chamber especially in comparison to the other eye, and lower intraocular pressure. Our patient had a normal anterior segment exam and intraocular pressure comparable to the other eye and demonstrated a very localized rather than diffuse subconjunctival hemorrhage. Although some studies which we have mentioned previously reported penetrating globe injury secondary to Dermojet use, our case report demonstrates sequelae of blunt trauma, which highlights the significant jet force this technology utilizes.

In blunt trauma, there is mechanical compression sustained by the eyeball that is followed by rapid hyperextension.[11] Given its high tensile strength, the sclera resists these forces, and the retina, which is elastic, stretches during such an injury. Moreover, breaks in Bruch's membrane can happen due to its insufficient tensile strength and elasticity. Certain conditions are known to increase the risk of choroidal ruptures due to abnormally brittle or weak Bruch's membrane. This causes choroidal rupture to occur with even minimal trauma. Such conditions include high myopia, pseudoxanthoma elasticum, Ehlers-Danlos, and angioid streaks[12,13]. In our reported case, the patient did not have any conditions that predisposed her to choroidal rupture, signifying the amount of force that Dermojet exerts as the most probable cause. Injury to the choriocapillaris, which is a feature of choroidal rupture, may cause bleeding into the sub-RPE and/or subretinal space. Such hemorrhage may mask the choroidal rupture in the initial stages. The blood usually clears over days, revealing a whitish/yellowish curvilinear crescentic subretinal streak usually concentric to the optic disc.[9] In our patient, a vitreous hemorrhage, rather than a subretinal or sub-RPE hemorrhage, masked the choroidal rupture initially.

There are two main types of choroidal ruptures: direct (20 %) and indirect (80 %).[14] Direct choroidal ruptures are frequently found closer to the ora serrata at the site of impact and usually occur secondary to a forceful, localized blow to the eye. On the other hand, indirect choroidal ruptures, which are more common, occur away from the site of impact, often present in a crescent pattern concentric to the optic disc, and usually found in the posterior pole due to the counter-coup effect of the trauma. In our case, the resultant choroidal rupture is most likely categorized into the less common direct type of choroidal rupture with the rupture occurring in the temporal retina in an area consistent with the site of impact which corresponds to the site of our patient's localized traumatic subconjunctival hemorrhage(Fig. 1).

Choroidal neovascularization (CNV), usually type 2, can develop following choroidal rupture and is a serious complication these patients may present with. Therefore, monitoring patients with choroidal rupture for CNV is vital. While most cases of CNV following choroidal rupture exhibit spontaneous resolution, in 10–15 % of cases, CNV may recur with serous or hemorrhagic pigment epithelial detachment[9,15]. In patients where the rupture or CNV does not involve the fovea, vision may not be affected, and treatment is usually not required. Risk factors for CNV formation after choroidal rupture include longer length of the rupture (>2.35 mm), macular location, older age (>65 years old). In most cases, CNV occurs in the first year of choroidal rupture[16,17]. In the case of our patient, the risk of visual complications from CNV is minimal considering the choroidal rupture is located away from the fovea. The length of the rupture is borderline and will most likely not pose an increased risk for CNV formation. Her younger age is considered protective. Despite this, the risks involved were explained to the parents and follow up was given and emphasized, especially during the first-year post injury. The patient and parents were educated about the red flag symptoms indicative of CNV and advised to seek urgent care if they occur.

The development of traumatic subconjunctival hemorrhage, vitreous hemorrhage, commotio retinae and choroidal rupture in our reported case confirms the significant jet-force associated with Dermojet's needle-less drug-delivery system. Proper precautions such as protective eyewear, careful handling, and judicious use of the device are therefore imperative to prevent such rare but serious incidents. Safer methods of drug delivery that do not require much experience are widely available, such as needle injection of steroids, are thus recommended when treating injury-prone areas such as the periorbita.

Based on this case report and other reported cases of significant traumatic injuries to the eye after Dermojet injection, we recommend that dermatologists consider needle injections of steroids for treatment of the sensitive and injury-prone periorbital area of the face. In our case, the dermatologist had ample practice with the use of Dermojet. Therefore it is best that even experienced dermatologists avoid the use of Dermojet injections in these sensitive areas, as ocular complications can potentially be detrimental and vision-threatening.

3. Conclusion

While Dermojet offers a needle-free approach to drug delivery, its high-pressure mechanism poses a unique set of risks, especially when administered in proximity to sensitive structures such as the eye. This case report highlights the risk of traumatic subconjunctival and vitreous hemorrhage, choroidal rupture, and commotio retinae as part of the possible complications of Dermojet injection delivered to the brow area. The presence of choroidal rupture and commotio retinae signify the large amount of force this kind of drug-delivery system exerts on the area it is applied to. Physicians, particularly dermatologists and ophthalmologists, should be aware of these rare yet potentially-blinding complications in order to make safer choices of drug delivery to the face and periorbital area. In general, given the risk of vision-threatening complications, we recommend against the use of high-pressure needle-less delivery systems in the periorbital area, even in the hands of experienced practitioners.

Funding statement

This research received no external funding. All aspects of the study, including research design, data collection, analysis, and manuscript preparation, were self-funded by the authors.

Informed consent statement

Appropriate written consent was obtained from the patient's mother when acquiring the provided figures in this publication.

AI statement

AI was not used in the writing or processing of this publication.

Authorship statement

The criteria for authorship as described by the International Committee of Medical Journal Editors has been met by all authors.

CRediT authorship contribution statement

Hend Alsafran: Writing – original draft, Supervision, Resources, Data curation, Conceptualization. **Ali Esmaeil:** Writing – original draft, Methodology, Data curation. **Alaa AlAli:** Writing – review & editing, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

None.

References

1. Krantz A. [The pressure-injector "Dermo-Jet"]. *Munch Med Wochenschr*. Oct 14 1960; 102:2034–2035.
2. Bekkers VZ, Bik L, van Huijstee JC, Wolkerstorfer A, Prens EP, van Doorn MBA. Efficacy and safety of needle-free jet injector-assisted intralesional treatments in dermatology—a systematic review. *Drug Delivery and Translational Research*. 2023/06/01 2023;13(6):1584–1599. https://doi.org/10.1007/s13346-023-01295-x.
3. Barolet D, Benohanian A. Current trends in needle-free jet injection: an update. *Clin Cosmet Investig Dermatol*. 2018;11:231–238. https://doi.org/10.2147/ccid.S162724.
4. Bik L, van Doorn MBA, Boeijink N, et al. Clinical endpoints of needle-free jet injector treatment: an in depth understanding of immediate skin responses. *Lasers Surg Med*. Jul 2022;54(5):693–701. https://doi.org/10.1002/lsm.23521.
5. Mitragotri S. Current status and future prospects of needle-free liquid jet injectors. *Nat Rev Drug Discov*. 2006/07/01 2006;5(7):543–548. https://doi.org/10.1038/nrd2076.
6. Fjellner B, Herczka O, Wennersten G. Complications in the intralesional injection of triamcinolone acetonide by jet injector (Dermojet). *Acta Derm Venereol*. 1983;63(5): 456–457.
7. Barak Y, Amiran MD, Fineberg E, Lang Y. Perforating eye injury caused by a Dermojet syringe. *Arch Dermatol*. Aug 2009;145(8):958–960. https://doi.org/10.1001/archdermatol.2009.162.
8. Perry HT, Cohn BT, Nauheim JS. Accidental intraocular injection with Dermojet syringe. *Arch Dermatol*. 1977;113(8). https://doi.org/10.1001/archderm.1977.01640080133036, 1131-1131.
9. Lupidi M, Muzi A, Castellucci G, et al. The choroidal rupture: current concepts and insights. *Surv Ophthalmol*. 2021/09/01/2021;66(5):761–770. https://doi.org/10.1016/j.survophthal.2021.01.014.
10. Singh S, Saxena S. Unraveling the perplexities of choroidal rupture. *Indian J Ophthalmol*. Jun 2023;71(6):2602–2603. https://doi.org/10.4103/ijo.Ijo_326_23.
11. Nair U, Soman M, Ganekal S, Batmanabane V, Nair K. Morphological patterns of indirect choroidal rupture on spectral domain optical coherence tomography. *Clin Ophthalmol*. 2013;7:1503–1509. https://doi.org/10.2147/opth.S46223.
12. Asanad S, Bayomi M, Brown D, et al. Ehlers-Danlos syndromes and their manifestations in the visual system. *Front Med*. 2022;9, 996458. https://doi.org/10.3389/fmed.2022.996458.
13. Li Y, Nadelmann JB, McGeehan B, VanderBeek BL. Systemic disease Associations with angioid streaks using a U.S. National healthcare database. *Investigative Ophthalmology & Visual Science*. 2021;62(8), 172-172.
14. Moon K, Kim KS, Kim YC. A case of expansion of traumatic choroidal rupture with delayed-developed outer retinal changes. *Case Rep Ophthalmol*. 2013;4(2):70–75. https://doi.org/10.1159/000354197.
15. Karampelas M, Malamos P, Petrou P, Georgalas I, Papaconstantinou D, Brouzas D. Retinal pigment epithelial detachment in age-related macular degeneration. *Ophthalmol Ther*. Dec 2020;9(4):739–756. https://doi.org/10.1007/s40123-020-00291-5.
16. Ament CS, Zacks DN, Lane AM, et al. Predictors of visual outcome and choroidal neovascular membrane formation after traumatic choroidal rupture. *Arch Ophthalmol*. Jul 2006;124(7):957–966. https://doi.org/10.1001/archopht.124.7.957.
17. Secrétan M, Sickenberg M, Zografos L, Piguet B. Morphometric characteristics of traumatic choroidal ruptures associated with neovascularization. *Retina*. 1998;18 (1):62–66. https://doi.org/10.1097/00006982-199801000-00011.