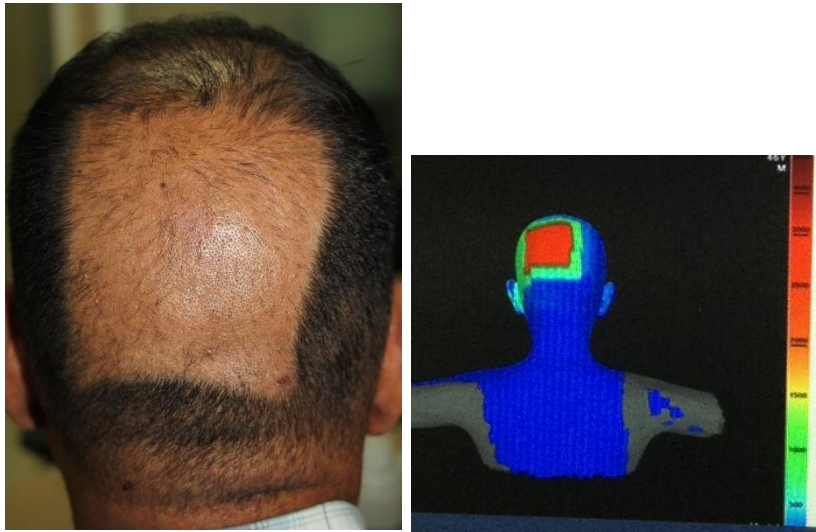


### Case 8

A 46-year-old Thai man from Pichit province

**Chief complaint:** Rectangular alopecia for 2 weeks



**Present illness:** The patient had noticed abnormal hair loss for 2 weeks and presented to our clinic with sharply demarcated rectangular alopecia on the occipital scalp with only mild pruritus.

#### **Past history**

He had right traumatic carotid-cavernous fistula and optic neuropathy as a result of a car accident 10 months ago and underwent two courses of cerebral angiography with fistula embolization under fluoroscopy 4 and 1 months ago, respectively, without any complication. Monitoring of the patient's radiation exposure were done only in the second intervention with total radiation exposure time was 67 minutes, and peak skin dose was 2.9 Gy.

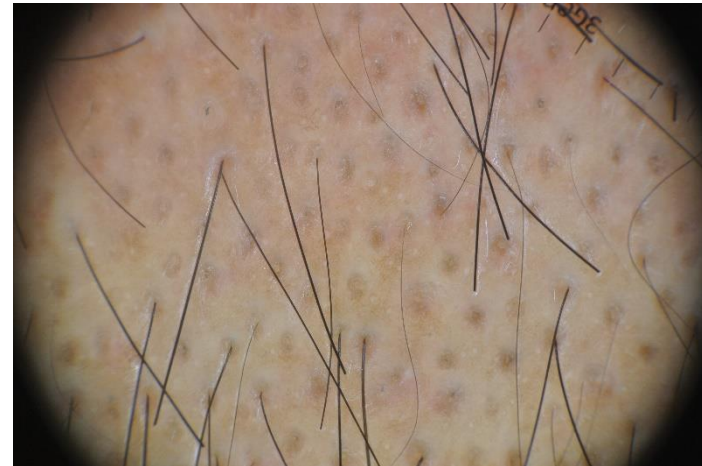
#### **Physical examination**

Eyes: Light perception right eye

Physical examination other than eye and skin revealed no abnormality.

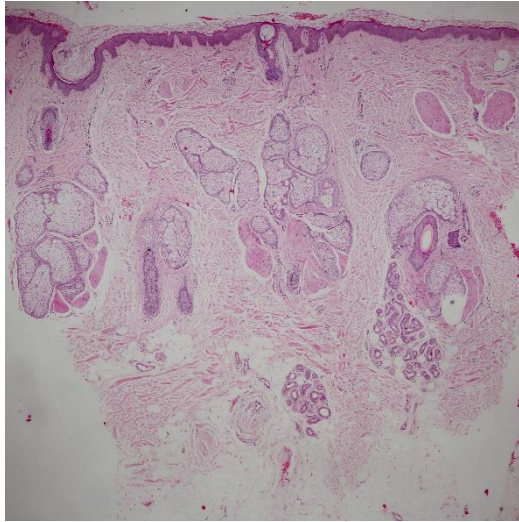
#### **Skin examination**

Sharply demarcated rectangular non-scarring alopecia, size 10x12 cm, on the occipital scalp, without erythema or scale. Hair pull test was positive in the periphery of the alopecic patch and revealed 100% telogen hairs. Dermoscopic examination was done and showed black dots, yellow dots, and short vellus hairs.



#### **Histopathology** (S15-018250, scalp)

- An increase number of catagen/telogen follicles from scalp skin
- Absence of inflammation or fibrosis around the hair follicle



**Diagnosis:** Radiation-induced alopecia after endovascular embolization under fluoroscopy

#### **Treatment**

- Reassurance of the patient about the benign nature and self-limiting of the alopecia
- 5% Minoxidil lotion apply twice daily

**Presenter:** Vipawee Ounsakul, MD

**Consultant:** Poonkiat Suchonwanit, MD

#### **Discussion:**

Alopecia after fluoroscopically-guided endovascular procedures are rarely reported in the dermatological literature, although this complication is possibly relatively common due to an increasing use of endovascular procedures which often requires prolonged and recurrent fluoroscopic imaging that

might cause radiation injuries to skin such as dermatitis or alopecia.<sup>1,2</sup>

Radiation threshold doses for derterministic effects of the skin proposed by the International Commission on Radiological Protection (ICRP) are 2 Gy for transient erythema, 3–6 Gy for temporary epilation, 7 Gy for permanent epilation, 10 Gy for moist desquamation, and 18 Gy for dermal necrosis.<sup>3,4</sup> Although the scalp is very resistant to radiation exposure, alopecia paradoxically presents at lower dose of radiation than the rest of the body.<sup>5</sup> Jung et al. reported 9 cases (6.7%) with alopecia in 135 patients treated for aneurysm by coiling embolization. Severity of radiation-induced temporary alopecia depends on the dose, total duration, interval between irradiations, size of area irradiated, angle of irradiation, and patient-related factors.<sup>6</sup>

Pathogenesis of radiation-induced alopecia is acute damage to actively dividing matrix cells of anagen follicles causing immediately loss of dystrophic anagen hairs (anagen effluvium) and premature entry of anagen phase hairs into catagen and then into telogen phase, leading to premature hair shedding which is responsible for delayed onset of alopecia.<sup>1</sup> In our patient, the presence of telogen hairs without dystrophic anagen in trichogram was a result of prolonged time from radiation exposure to examination. Alopecia after endovascular procedures may also be secondary to impairment of the external carotid blood supply of the scalp or pressure-induced. However, the optimal superficial temporal and occipital arterial blood supply, and partly matching of alopecic patch with the pressure area in our patient denied these two latter hypotheses.

Clinical presentation of radiation-induced alopecia includes geometric shapes of non-scarring alopecia related to the area of radiation, usually asymptomatic without sign of scalp inflammation. Common affected scalp areas are occipital, parietal and temporal. Hair loss mostly occurs within 1-3 weeks after radiation exposure with spontaneous regrowth of hair

within 2-4 months.<sup>8-12</sup> Cho et al. reported 10 patients who developed alopecia after angioembolization with mean duration 3.4 weeks after procedure. All patients had a rectangular-shaped, alopecic patch occurred on the occipital and temporal area, and 9 from 10 patients had complete hair regrowth within 3-4 months.<sup>7</sup>

Diagnosis of radiation-induced alopecia is primarily based on distinct clinical presentation and history of radiation exposure. Investigations including trichogram, dermoscopy, and histopathology are more likely to exclude other non-scarring alopecia than to confirm the diagnosis.<sup>7</sup> Dermoscopic findings in 10 patients with post-angioembolization alopecia showed both yellow and black dots (60%), short vellus hair (50%), peripilar sign (20%), broken hair (10%), coiled hair (10%) and white dots (10%), while histopathological findings revealed increased numbers of catagen and telogen hairs without peribulbar inflammatory cell infiltrate.<sup>7</sup>

Treatment of radiation-induced alopecia is usually unnecessary due to benign nature of this condition and complete hair regrowth generally occurs within 2–4 months after irradiation.<sup>8-12</sup> In addition, no treatment or prevention method appear to be generally effective. To prevent this unwanted effect, awareness and limitation of radiation exposure to the patient is the most important. Online monitoring of the patient's radiation exposure is also necessary because fluoroscopy time does not account for either fluoroscopic dose rates or the use of fluorographic acquisition modes during a procedure.<sup>2,6</sup>

## References

1. Vaccaro M, Guarneri F, Brianti F, Cannavo SP. Temporary radiation-induced alopecia after embolization of a cerebral arteriovenous malformation. *Clin Exp Dermatol*. 2015; 40(1): 88–90.
2. Gavagan L, Ti J, Thornton J. Is hair loss a reality in neuro-interventional radiology? *Radiat Prot Dosimetry*. 2011;147(1–2):68–71.
3. Valentin J. Avoidance of radiation injuries from medical interventional procedures. *Ann ICRP*. 2000;30(2):7-67.
4. Mooney RB, McKinstry CS, Kamel HA. Absorbed dose and deterministic effects to patients from interventional neuroradiology. *Br J Radiol*. 2000;73(871):745-51.
5. Jung YH, Park SH, Kim YS. Six year experience of endovascular embolization for intracranial aneurysms. *J Korean Neurosurg Soc*. 2005;38:190-5.
6. Balter S, Hopewell JW, Miler DL, Wagner LK, Zelefsky MJ. Fluoroscopically guided interventional procedures: a review of radiation effects on patients' skin and hair. *Radiology*. 2010;254(2):326-41.
7. Cho S, Choi MJ, Lee JS, Zheng Z, Kim Y. Dermoscopic findings in radiation-induced alopecia after angioembolization. *Dermatology*. 2014;229(2):141–5.
8. Verma S, Srinivas C, Thomas M. Radiation-induced temporary alopecia after embolization of cerebral aneurysm. *Indian J Dermatol*. 2014;59(6):633.
9. Podipnik S, Giavedoni P, San RL, Ferrando J. Square alopecia: a new type of transient alopecia of the scalp following fluoroscopically endovascular embolization. *Int J Trichology*. 2013;5(4):201–3.
10. Lopez V, Lopez I, Ricart JM. Temporary alopecia after embolization of an arteriovenous malformation. *Dermatol Online J*. 2012;18(9):14.
11. Thorat JD, Hwang PY. Peculiar geometric alopecia and trigeminal nerve dysfunction in a patient after Guglielmi detachable coil embolization of a ruptured aneurysm. *J Stroke Cerebrovasc Dis*. 2007;16(1):40-2.
12. Wen CS, Lin SM, Chen Y, Chen JC, Wang YH, Tseng SH. Radiation-induced temporary alopecia after embolization of cerebral arteriovenous malformations. *Clin Neurol Neurosurg*. 2003;105(3): 215-7.