CASE REPORT

Radiodermatitis after spinal arteriovenous fistula embolisation

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SUMMARY

We report acute radiation dermatitis on a patient's back and left arm, which developed 4 weeks after endovascular embolisation of a spinal arteriovenous malformation. Vesciculation and erosions were followed by a gradual re-epithelisation of the skin resulting in rectangular hyperpigmented patches that resolved almost completely within 1 month. Fluoroscopic radiodermatitis has been reported with more frequency over the past decades because of the rise in duration and number of procedures performed under fluoroscopic guidance. Articles concerning this issue are mostly limited to case reports after coronary interventions, renal artery catheterisations, transjugular intrahepatic portosystemic shunt procedures and embolisations of intracranial arteriovenous malformation. To the best of our knowledge, only two cases of radiation dermatitis after spinal arteriovenous malformation embolisation have been reported to date.

BACKGROUND

The first cases of radiodermatitis due to interventional procedures were described in the early 1990s, especially following radiofrequency catheter ablation and coronary angioplasty.^{1 2} The progressive increase in use of fluoroscopically guided diagnostic and interventional procedures has resulted over the past decades in new sporadic cases of radiation-induced dermatitis.

CASE PRESENTATION

A 49-year-old man with a 2-year history of fatigue, arrhythmia and episodic low back pain, underwent a spinal MRI, which documented a high-flow vascular malformation involving the T12 vertebral body with no damage of the spinal cord. The spinal angiography confirmed an osteodural arteriovenous fistula supplied by the intercostal arteries T10 left and right, T11 right and T12 left, with an intraosseous shunt at the T12 vertebral body. The patient was later hospitalised in the neurosurgery department, where he underwent an endovascular embolisation that occluded the entire lesion by means of coil deployment and Onyx injection. The procedure required the retrograde catheterisation of the Azygos and ascending lumbar veins, and the selective catheterisation of the feeding lumbar arteries. The whole procedure lasted for 6 h and a total of 226 min of fluoroscopy was carried out using a biplane Philips Allura FD angiography system. The cumulative radiation doses for seriographies and roadmapping to which the patient was exposed were respectively 8 and

120 m Gy on the anteroposterior view, and 24 and 360 m Gy on the lateral view. The cumulative dose to the dorsal skin was 3.7 Gy and the dose to the skin of the left arm was 9.6 Gy. Four weeks later, the patient was referred to a dermatological consultation because he noted a rash over his back and left arm. Examination revealed three erythematous rectangular patches (figure 1), one about 15×3 cm in the paravertebral area, another about 12×8 cm under the left shoulder blade and the third about 10×8 cm on the extensor surface of the left arm. The patch on the arm was characterised by vivid erythema, mild oedema and a shiny and warm surface. No ulcers and no erosions were noted. The patient reported a burning sensation on the patches. The anatomic position of the skin injury corresponded to the angle of fluoroscopy exposure used for the radiological procedure. A diagnosis of acute radiation dermatitis was made and a therapy with topical steroid was started.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis may include chemical burn, sunburn, contact dermatitis and photodermatitis. Nevertheless, neither sun exposure nor topical drug application in the previous days was reported by the patient.

OUTCOME AND FOLLOW-UP

After 1 week, examination of the patch on the left arm revealed vesciculation and a central erosion, whereas the lesions on the back were stationary. The topical steroid was continued once a day for 4 weeks achieving a gradual lessening of the tenderness with re-epithelisation of the skin, leaving

Figure 1 One patch on the left arm and two patches on the back characterised by erythema, faint oedema and well-defined borders.

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Figure 2 (A and B) Clinical improvement of the lesions after 4 weeks. The patches gradually resolved becoming hyperpigmented with fine scales.

rectangular hyperpigmented patches with fine superficial scales (figure 2A, B).

DISCUSSION

Several cases of radiodermatitis secondary to interventional endovascular procedures have been reported since early 1990s, mainly from interventional cardiology such as radiofrequency catheter ablation and coronary angioplasty.^{1 2} The cumulative radiation doses to which the patients were exposed in these procedures, notably higher than in any other routine procedures, are compatible with the occurrence of radiodermatitis. The acute skin injuries in radiodermatitis are divided into first, second and third-degree reactions.¹ First-degree reactions are characterised by erythema and oedema with slight burning or pruritus, followed by a brown-red hyperpigmentation that generally resolves in about a month. In second-degree radiodermatitis there is also vesiculation, with erosion and superficial ulceration, which heal in 6–12 weeks. A permanent epilation may occur. Third-degree reaction occurs when there is deeper ulceration and necrosis, and may involve the subcutaneous tissue, bone and even viscera. The cutaneous effects of localised radiation correspond to different doses of absorbed radiation, as suggested by the National Cancer Institute.³ These are: A1 (0–2 Gy) no grade; A2 (2–5 Gy) Grade 1; B (5–10 Gy) Grades 1–2, C (10–15 Gy) Grades 2–3 and D (>15 Gy) Grades 3–4. However, it is now agreed that these doses are not rigid boundaries; furthermore, skin dosimetry is unlikely to be more accurate than $\pm 50\%$. Skin injuries are also influenced by patient-related factors such as smoking, poor nutritional status, compromised skin integrity, pre-existing connective tissue or autoimmune disease and by the order of radiosensitivity: higher to lower is anterior neck, flexor surface of extremities, trunk, back, nape of neck and scalp.³ Fluoroscopic radiodermatides have been reported with increasing frequency over the past decades because of the rise in duration and number of procedures performed under fluoroscopic guidance. Despite increased awareness, there is no real-time indicator of patient skin dose that can be observed during the procedure.⁴ Current fluoroscopes are able of producing dose rates of 0.2 Gy/min, but the dose rate often changes with patient positioning and size.⁵ The risk of related radiodermatitis has not been examined in large cohort studies. Reports are mostly limited to case reports after coronary interventions,¹ renal artery catheterisation,² transjugular intrahepatic portosystemic shunt procedures⁶ and embolisation of intracranial arteriovenous malformations.⁷ To the best of

our knowledge, only two cases of radiation dermatitis after spinal arteriovenous malformation embolisation have been reported: they both describe patients who presented with lesions on the back after three separate procedures.^{8 9} Interventional neuroradiological procedures are used to treat a number of neurovascular disorders, both central and peripheral. Procedures are lengthy and multiple interventions are often necessary for more complex vascular malformations. Physicians performing interventional procedures should be aware of the potential side effects and must be proactive in limiting radiation doses. Long exposure to radiation will be more frequent in the near future to cure complex arteriovenous lesions due to new embolisation techniques that use liquid embolic agents.

Patients should be monitored for these complications, especially when they undergo complex interventional radiological procedures with fluoroscopic exposure exceeding 60 min.¹ Some procedural techniques have been suggested to diminish the radiation exposure,¹ such as using pulse fluoroscopic imaging systems, which produce radiation in short pulses, opposite to continuous mode. Collimation of the radiographic beam to the smallest field size necessary for each procedure will also minimise the radiation risk. Moreover, to reduce the risk of focal high-dose exposure in a restricted area should be suggested, if possible, to change the arch position during the procedure. Positioning of the patient with respect to the X-ray tube and the detector is very important to restrict the radiation dose to the patient. Tube angulations influence the exposure significantly due to the large effect on the projected path through the

Learning points

- ▶ Radiodermatitis should be considered as an adverse event after procedures such as endovascular embolisation of spinal arteriovenous malformation.
- ▶ Patients undergoing fluoroscopically guided procedures should be previously informed about the risk of development of these skin injuries.
- ▶ Dermatitis usually appears 3–4 weeks after the radiological procedure, involving specific areas corresponding to the angle of fluoroscopy exposure.

patient. Integral to good practice is to position the patient as closely as possible to the detector.¹⁰ Finally, in order to reduce the patient's radiation exposure to long complex embolisation or to multiple shorter procedures, new generation angiographic systems should be equipped with specific dose-reducing software.

Since skin lesions become evident after 3–4 weeks after the causative exposure, the patient and the consulting physician frequently fail to link dermatitis to radiation exposure. Patients should be previously informed about the potential tardive onset of lesions, also in different areas from those treated, possibly requiring a prompt specialist consultation to initiate appropriate treatment and follow-up.

Competing interests None declared.

Patient consent Obtained.

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