

Post Irradiation Myelopathy: From the Physiatrists' Point of View

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SUMMARY

We describe two patients who developed a severe spinal cord damage long time after cessation of irradiation therapy. The various and unique rehabilitation medicine aspects are discussed and the literature is surveyed.

Key words: spinal cord damage, rehabilitation medicine, post irradiation myelopathy

BACKGROUND

The subject of post irradiation myelopathy is usually dealt in depth in the oncological or radiological literature. "Radiation myelopathy is a rare but devastating injury to the spinal cord that usually results from an excessive radiation dose. A distinction is made between radiation damage, which occurs at the sub-cellular level, and radiation injury, which occurs at the tissue and organ level in response to radiation damage." [1].

Radiation therapy near or around the spinal cord, can cause neural toxicity. Nervous system toxicity is usually subdivided into acute (during the course of radiation), early delayed (weeks to three months after radiation), and delayed reaction (more than three months). The first report on this relatively rare complication, was published in 1941 [2].

CASE REPORT

A 50 year old man, married with three children, fell on his back in 1973. Since the fall he complained of upper and lower back pain. A few months later, he felt some "swellings and local hardenings" over his upper dorsal area. A para-vertebral muscle biopsy was performed which followed by local infection and fibrotic changes. Local operations were needed to excise these lesions. In 1974 he was diagnosed as suffering (retrospectively, wrongly!) from a sarcoma of this region. Radiation therapy was prescribed: we cannot find the exact dosage of irradiation over the D1-S1 area. In 1985 he underwent a thorough investigation and re-assessment in a large oncological center in the US, which, retrospectively, confirmed the diagnosis of nodular fasciitis and not sarcoma. During 1997 he underwent more local plastic operations. From 1999 he developed a slow ascending myelopathy: initial double sphincters' paralysis, impotence, upper limbs' paresthesias, which followed by ascending paralysis. At this stage he was already confined to a wheel-chair. A thorough neuro-radiological, neurological and neuro-physiological investigations showed eventually that sadly he was developing a slowly progressive ascending post-irradiation upper motor neuron and lower-motor-neuron-lesion myelitis.

A complex dermatological disease [seborrheic dermatitis, urticaria, intertrigo, keratosis pilaris and lichen spinulosus] necessitated cortico-steroid treatment, which resulted in hypertension and insulin dependent diabetes.

An MRI done in 2006 showed a compression on his cervical cord between c 3/4 and C 4/5, due to protruded intervertebral discs, and ligamentum flavum thickening. It is possible that the discal pathology

was resulted from frequent falls and asymmetrical gait along the years, prior to his confinement to wheel-chair.

Today his problems are enormous: painful burning sensation over his limbs, still has an irritating skin problem, frequent trans-urethral dilatations of urethral stricture, movement limitation of both shoulders, painful back scars, spastic tetraplegia below C7, hypoesthesia below C6, and peripheral paresthesiae.

He is totally dependent upon other in all ADLs. He manages to drive his adapted car, and enjoy three times a week physiotherapy and hydrotherapy. He underwent recently cervical operation to relieve pressure from the stenotic areas, complains of fatigue and weakness. Night sleep is frequently disturbed by painful spastic "waves".

The second patient is a 46 year old woman, married with four children, who was hospitalized after developing upper vena cava obstruction. CT showed a huge tumor which penetrated into the mediastinum. Biopsy revealed T cells lymphoblastic lymphoma. She got 3800 rad irradiation that caused the tumor disappearance. A combined five cycles of chemotherapy followed, with dexamethason, vincristine, adriamycin and cyclophosphamid. Later one course of methotrexat and leukoverin was given. Six months later she developed dyspnea due to pneumonitis which subsided after steroids treatment. A year and half later, she was found to develop right spastic hemiparesis. LP showed 63mg% of protein in her CSF. MRI demonstrated some swelling (it was speculated either it was an inflammation or necrosis) from the brain stem down to D4 level. Steroids improved her condition but two weeks later she developed paraparesis below D4. Hyperbaric oxygen therapy failed to affect her condition. A month later, her neurological status worsened: now she was found to suffer from an incomplete tetraplegia below c4!. She became wheel-chair bound and totally dependent upon others in all ADLs. She lost control over her sphincters.

DISCUSSION

The nature of neurological damage after irradiation close to the spinal cord, can span from an acute damage (vascular insult?) or slowly progressive myelopathy.

Rare lower motor neuron damage syndromes after radiation therapy were reported [3-4]. Is it a damage to motor neuron cell bodies or from damage to the nerve roots of the cauda equine? [4].

Oncologists and radiologists tried to define the tolerance of the cervical spinal cord to therapeutic radiation [5], and pathologists and clinicians – the

histological/pathological damages [6-8]. It is estimated that the spinal cord can be compromised by three different mechanisms: direct injury, vascular damage and collagen fibers' hyalinization. It is difficult to rule-out a remote-effect of the irradiated primary tumor, secondary local spinal cord infection-viral or bacteriological or sometimes-a Guillain-Barre' syndrome.

Radiation myelopathy is mainly a white matter damage of the spinal cord induced by ionizing radiation after a certain latent period. " It involves myelinated fibers and blood vessels, and the lateral funiculi is most preferentially affected. Several factors, such as radiation dose, fractionation or linear energy transfer, modify its occurrence and severity. Although glial cells and vascular endothelium are proposed to be the main targets, and to play a role in the pathogenesis of radiation myelopathy, experimental researches support that radiation-induced vascular damage resulting in vascular hyper-permeability and venous exudation is a basic process." [6].

Generally speaking, patients who received irradiation near the spine may develop [9]:

- Myelopathy
- Gastro-intestinal complications like diarrhea or nausea
- Bone marrow suppression
- In children- developmental disturbances

The main parameters regarding myelopathy following irradiation, are [10]:

- Pace and dosage of radiation
- Extent of spinal protection
- Individual sensitivity to irradiation
- Extent of tissues exposure to radiation

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- The extent of damage of the blood supply to the area

The rehabilitation process is unusual: after the period of coping with the initial diagnosis and complicated treatments, patients face a secondary changes-progressive neurological deterioration which confine them eventually to wheel-chairs, cause them to loss control over their sphincters and dependence upon others in ADLs. Tertiary complications occur, like, depression, despair, spondyloarthritis, osteoporosis, intervertebral disc herniations, and more. The fourth grade complications includes metabolic syndrome due to corticosteroids administration.

Patients and families wonder if these secondary and tertiary complications do occur due to initial maltreatment? Did the initial necessary treatments of radiation and chemotherapy caused spinal cord damages? How to cope with changing rehabilitation needs? Whenever re-appearance of tumor occur – is re-radiation therapy is justified with greater risk for the cord? Psychologically, patients feel "double blow" – the primary disease and the complications and disabilities which follow. The proper management of these patients necessitates full co-operation between physiatrists, family physicians/home care units and oncologists.

This presentation tries to focus attention of physiatrists to this clinical picture which are relatively rare [11-16].

It is also important to stress that delayed myelopathy can follow severe electrical burns [17], and therapeutic total-body hyperthermia after spinal cord irradiation [18-19].

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