When Brachial Plexopathy Hides Malignancy
A Literature-Informed Approach to Post-Radiation MPNST

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Background

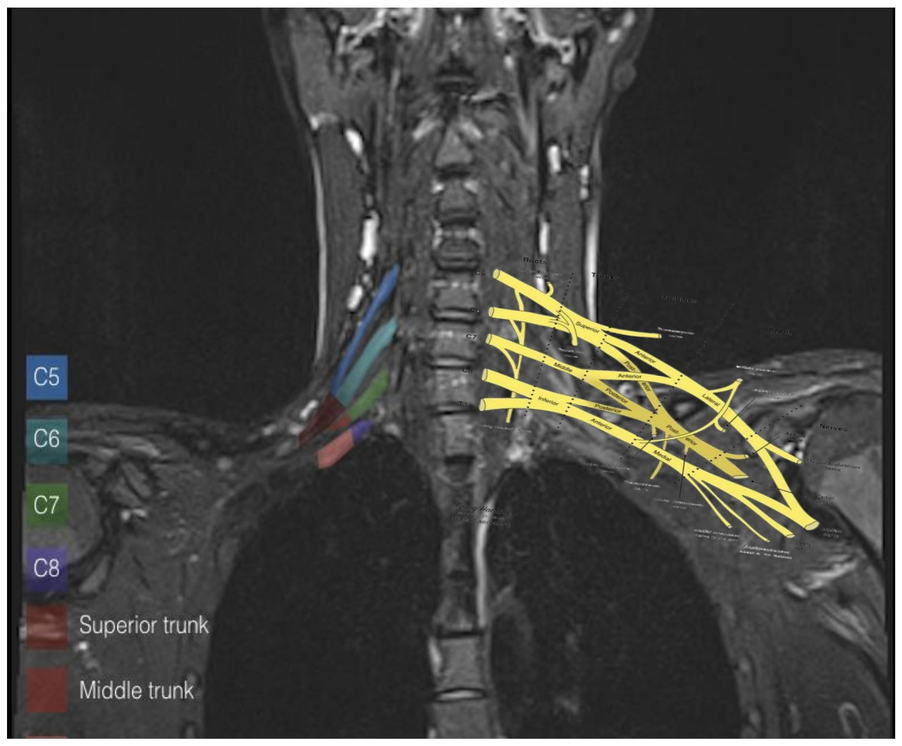
The brachial plexus supplies the entire motor and sensory outflow to the upper limb and is frequently encompassed—intentionally or incidentally—by radiation fields used to treat breast, thoracic, and head-and-neck malignancies.

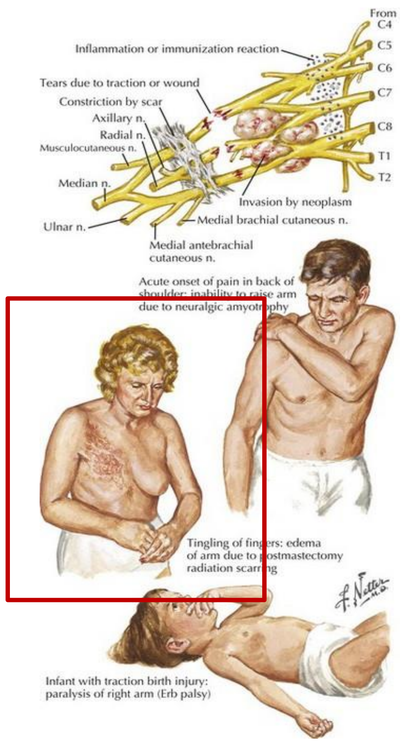
Brachial plexopathy (BP) is therefore a recognised, albeit uncommon, late adverse event: its prevalence is ≈0.4 % in the general oncology population and rises to 2–5 % among patients who have undergone radiotherapy.

Most post-radiation cases reflect radiation-induced brachial plexopathy (RIBP), a non-neoplastic fibrotic or demyelinating injury that typically manifests after a latency of several months to years.

A distinct and far less common complication is the radiation-induced malignant peripheral nerve-sheath tumour (RI-MPNST). MPNSTs—aggressive soft-tissue sarcomas arising from Schwann cells or neural-crest derivatives—occur predominantly in individuals with neurofibromatosis type 1, yet ≈45 % are sporadic and ≈10 % are attributable to previous irradiation. When RI-MPNST develops within the brachial plexus it may present with neuropathic pain and sensorimotor deficits that closely resemble those of RIBP or metastatic plexopathy, thereby obscuring the differential diagnosis in irradiated patients, particularly breast-cancer survivors.

Misclassification can delay definitive oncologic management of a lethal sarcoma or, conversely, expose patients with benign plexopathy to unnecessary interventions, with substantial implications for morbidity and mortality. A clear understanding of the epidemiological profile, latency patterns, and characteristic clinical–radiological features of both RIBP and RI-MPNST is therefore essential for neurologists, oncologists, and radiologists tasked with evaluating new brachial-plexus symptoms in long-term cancer survivors.

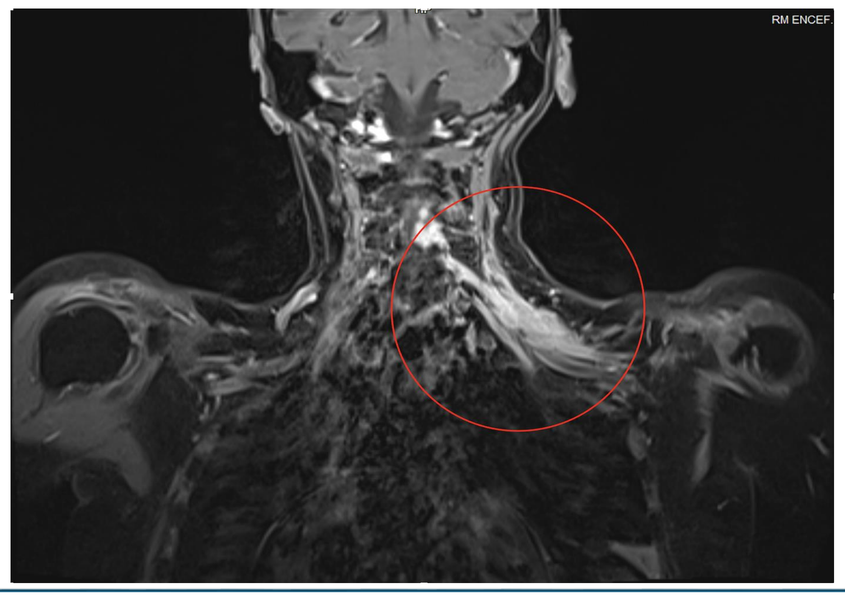




Two explicative cases

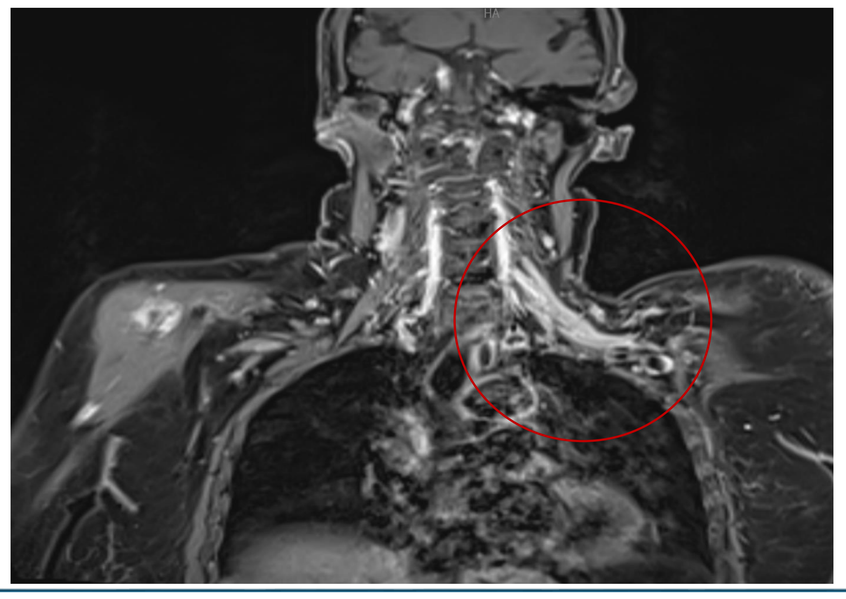
RI-MPNST brachial plexopathy

Case 1: A woman in her sixties with a history of mantle-field radiotherapy for Hodgkin lymphoma presented with progressive left upper limb weakness and severe shoulder pain. Initial investigations, including MRI. cerebrospinal fluid (CSF) analysis, and positron emission tomography (PET), failed to provide a conclusive diagnosis. CSF cytology revealed atypical cells, and a targeted intradural biopsy confirmed MPNST. Despite symptomatic treatment, the patient succumbed to the disease 20 months post-onset.



RIBP

Case 2: A 66 years old woman with prior breast radiotherapy developed insidious paresthesia and severe neuropathic pain in her left upper limb. Imaging revealed fibrotic changes and minimal nerve thickening without focal hypermetabolism. Neurophysiology confirmed brachial plexopathy, while CSF was unremarkable, supporting a diagnosis of RIBP. Symptomatic treatment improved her pain but did not reverse motor deficits.



Brachial Plexopathy from RI-MPNST, Literature Review

#	First author (year)	Sex	Age at onset (y)	Primary tumour / RT (dose)	Latency (y)	First symptoms	Motor loss	Sensory loss	Pain	EMG / NCS	Imaging (US/MRI)	FDG-PET	Survival & outcome
1	Foley 1980 Pt 1	M	22	Hodgkin; mantle + axilla, 2 × 36 Gy	2	enlarging, painful supraclavicular mass	N/R	N/R	✓ severe	N/R	N/R	N/A	Died 8 mo after Dx
2	Foley 1980 Pt 2	F	53	Breast Ca; cervical/SCV fields, total ≈40 Gy (triton type)	10	progressive plexopathy	✓	N/R	✓	N/R	N/R	N/A	Died 7 mo after Dx
3	Foley 1980 Pt 4	F	48	Hodgkin; mantle fields, 42 Gy	16	painful shoulder weakness	✓	N/R	✓	N/R	N/R	N/A	Alive at last FU
4	Foley 1980 Pt 6	F	54	Breast Ca; SCV/axilla 50 Gy	6	arm pain → palsy	✓	N/R	✓	N/R	N/R	N/A	Died 24 mo after Dx
5	Ferraresi 2017	M	48	Hodgkin; 30 Gy	25	insidious palsy, Horner, pain	✓ subtotal	mild	✓ severe	N/R	MRI initially negative; later spinal mass	PET hyper-captation	Died 13 mo after surgery
6	Chen 2023	F	34	Breast Ca; adjuvant RT (dose N/R)	N/R	nocturnal arm pain → weakness	✓ total	✓ paresthesia	✓ severe	Axonal plexopathy	US + MRI: diffuse thickening/nodules	SUV 24.4	Alive; good recovery
8	Alelaumi 2025	F	29	Nasopharyngeal Ca; 2-D RT 10 y earlier	10	neck/arm pain → weakness	✓ (C5–7)	✓ C5–6	✓	Axonal plexopathy	MRI: C4–6 root & plexus thickening	SUV 7.0	Alive (ongoing care)
7	Giordano Case 1	F	60	Hodgkin; mantle-field RT	40	shoulder pain + progressive weakness	✓	N/R	✓ severe	Axonal plexopathy	MRI + PET initially non-diagnostic	PET negative	Died 20 mo after onset

RI-MPNST Vs RIBP

	RI-MPNST brachial plexopathy	RIBP
Frequency after RT	Rare – radiation accounts for ≈ 5.5-11 % of all MPNSTs; only isolated brachial-plexus cases reported	Uncommon but much less rare: 0.4-1 % with modern breast-RT, up to 5-9 % with older techniques or dose > 50 Gy
Typical latency from radiotherapy	Mean ≈ 15 years (range 4 – 30 y)	Broad (6 mo – 30 y); median 4.3 y in large NPC cohort
First / predominant symptom	New, severe constant pain ± palpable mass, followed by rapidly progressive weakness	Paraesthesia is commonest first sign (≈ 52 %); pain usually later and milder
Plexus distribution	Often middle trunk / medial cord (C8-T1) involvement	Predominantly upper-middle trunks (C5-C7)
Electrodiagnosis	Axonal loss; myokymia absent	Mixed axonal-demyelinating changes; myokymic discharges in ≈ 84 %
MRI pattern	Focal or lobulated nodular mass, heterogenous T2, thick irregular enhancement, often infiltrating soft tissue	Smooth, fusiform, longitudinal nerve thickening with diffuse T2 hyper-intensity and thin linear enhancement; surrounding fibrosis
FDG-PET/CT	Frankly hyper-metabolic (SUV > 5–7; e.g., SUV 7.0 in case report)	Minimal / mild uptake; helps rule out tumour when MRI equivocal
Tempo of progression	Weeks-months; relentless without resection	Slow, step-wise over months-years; may plateau
Outcome / prognosis	High-grade sarcoma → poor 5-yr survival	Non-neoplastic; survival unaffected but chronic pain/weakness frequent; disability correlates with radiation dose
Key diagnostic clues	Lower-plexus pain plus rapidly enlarging mass; no myokymia; nodular MRI; high FDG uptake; biopsy mandatory	Upper-plexus sensory symptoms; myokymia on EMG; smooth “string-like” MRI thickening; low FDG uptake; biopsy only if imaging atypical

Conclusions

Although radiation-induced MPNST brachial plexopathy can initially mimic classic radiation-induced brachial plexopathy, the two must be distinguished promptly. RIBP emerges earlier (median ≈ 4 years), is initially sensory-predominant, shows myokymia, smooth fusiform MRI thickening, low FDG uptake and an indolent course. RI-MPNST brachial plexopathy usually appears > 10 years after irradiation, manifests itself with relentless pain and rapid motor loss, lacks myokymia, demonstrates a nodular or infiltrative mass with high SUV, and carries worse outcome. Recognising this constellation of signs and proceeding to early biopsy or resection is essential for appropriate management.

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