اسم المادة و الكورس

ACUTE PAIN MANAGEMENT 4

Sawa University

College of health and medical techniques

Department of Anesthesia

Fourth Stage

- جامعـــــة ساـــــاوة الاهلية
- كليـــــة التقنيـــات الصحيـة والطبيـة
- قسم تقنيـــات التخدير

أستاذ المادة :د.انمار رحمن كاظم

الجانب العملي

Practical

Acute Pain Management and Radiation Safety in Pain Procedures

Final-Year Medical Technology Students
Instructor: Dr. Anmar

Definition & Importance of Acute Pain

Acute pain is a sudden, time-limited physiological warning response.
It indicates tissue injury and triggers protective reflexes.
Early and effective management prevents chronic transition.

Pain Transmission Pathway

Peripheral nociceptors → Dorsal horn → Spinothalamic tract → Thalamus → Cortex.
A-delta fibers: sharp localized pain.
C fibers: dull, burning pain.
Central sensitization develops via NMDA receptor activation.

Pain Transmission Pathway

Peripheral nociceptors → Dorsal horn → Spinothalamic tract → Thalamus → Cerebral cortex

A-delta fibers:

Myelinated, fast conduction (5–30 m/s)

Transmit sharp, well-localized pain (mechanical/thermal)

C fibers:

Unmyelinated, slow conduction (0.5–2 m/s)

Transmit dull, burning, aching pain (polymodal)

Neurotransmitters involved:

Substance P, glutamate, CGRP released in the dorsal horn

Central sensitization:

Mediated by NMDA receptor activation, calcium influx, and microglial activation

Leads to hyperalgesia and allodynia

Allodynia means pain from a stimulus that normally doesn't cause pain — for example, feeling pain from a light touch, brushing the skin, or mild temperature change.

It results from central sensitization, where spinal or brain neurons become hyperresponsive, lowering the pain threshold.

CGRP (Calcitonin Gene–Related Peptide):
A neuropeptide released from peripheral and central terminals of sensory neurons. It contributes to neurogenic inflammation, vasodilation, and pain transmission by enhancing nociceptor excitability.

NMDA (N-Methyl-D-Aspartate) receptor:
A subtype of glutamate receptor located in the spinal dorsal horn and brain. Its activation allows calcium influx, leading to central sensitization, long-term potentiation of pain pathways, and development of chronic pain.

Molecular Mechanisms

Key mediators: prostaglandins, bradykinin, substance P, CGRP.{Calcitonin Gene Related peptide}
Peripheral sensitization lowers nociceptor threshold.
Central sensitization: increased synaptic transmission at dorsal horn neurons.

Clinical Goals of Acute Pain Management

1. *Rapid relief with minimal side effects.*
2. *Maintain hemodynamic stability.*
3. *Facilitate early ambulation and recovery.*
4. *Prevent chronic pain development.*

Assessment Tools

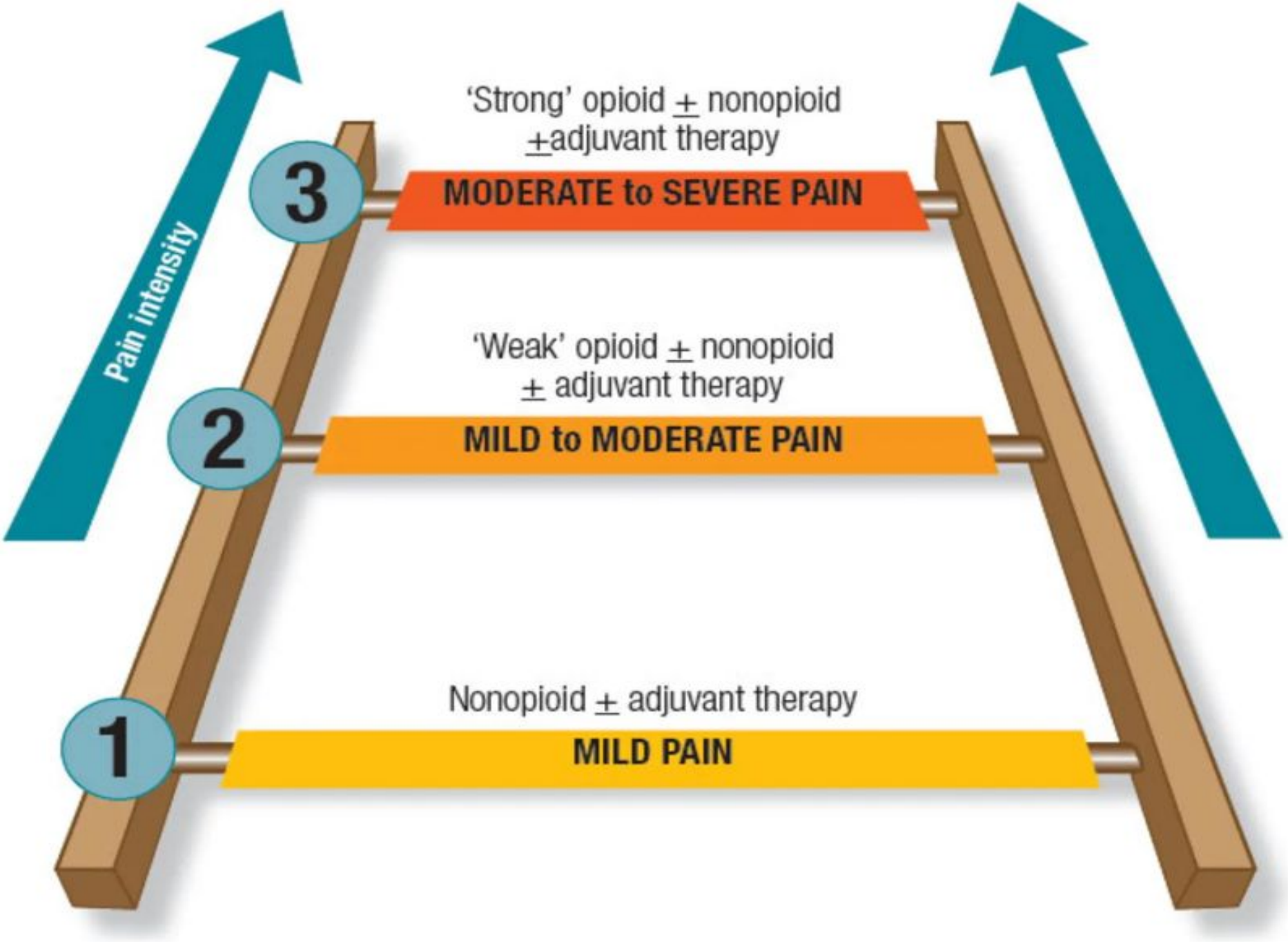
VAS, NRS, FLACC, and behavioral scales.
Pain reassessment every 4–6 hours.
Documentation critical for clinical safety.

Multimodal Analgesia Concept

Combination of drugs with different mechanisms.
Reduces opioid dose and side effects.
Targets multiple points in pain pathway.

Pharmacologic Strategies

Non-opioids: acetaminophen, NSAIDs.
Opioids: morphine, fentanyl, hydromorphone.
Adjuvants: ketamine, gabapentinoids.
Use stepwise WHO ladder approach.


Pain intensity
3
'Strong' opioid ± nonopioid
±adjuvant therapy
MODERATE to SEVERE PAIN
2
'Weak' opioid ± nonopioid
± adjuvant therapy
MILD to MODERATE PAIN
1
Nonopioid ± adjuvant therapy
MILD PAIN

Opioid Stewardship & Rotation

Start with short-acting opioids for titration.
Switch to long-acting if stable control achieved.
Monitor for respiratory depression, constipation, sedation.

Epidural opioids can migrate in CSF, causing delayed respiratory depression, especially with hydrophilic agents like morphine

Special Populations

Pediatric: weight-based dosing, avoid sedation.
Geriatric: dose reduction, renal adjustment.
Critical care: intravenous titration with hemodynamic

Complications of Poor Control

Tachycardia, hypertension, atelectasis, thrombosis.
Risk of chronic pain transition due to central sensitization.

Introduction to Radiation in Pain Procedures

- Used for fluoroscopy-guided epidural, RF ablation, nerve root block.
- Improves safety and accuracy of interventional pain practice.

Radiation exposure

As fears of a meltdown in Japan rise, so do the fears of radiation exposure. What does radiation do to the human body?

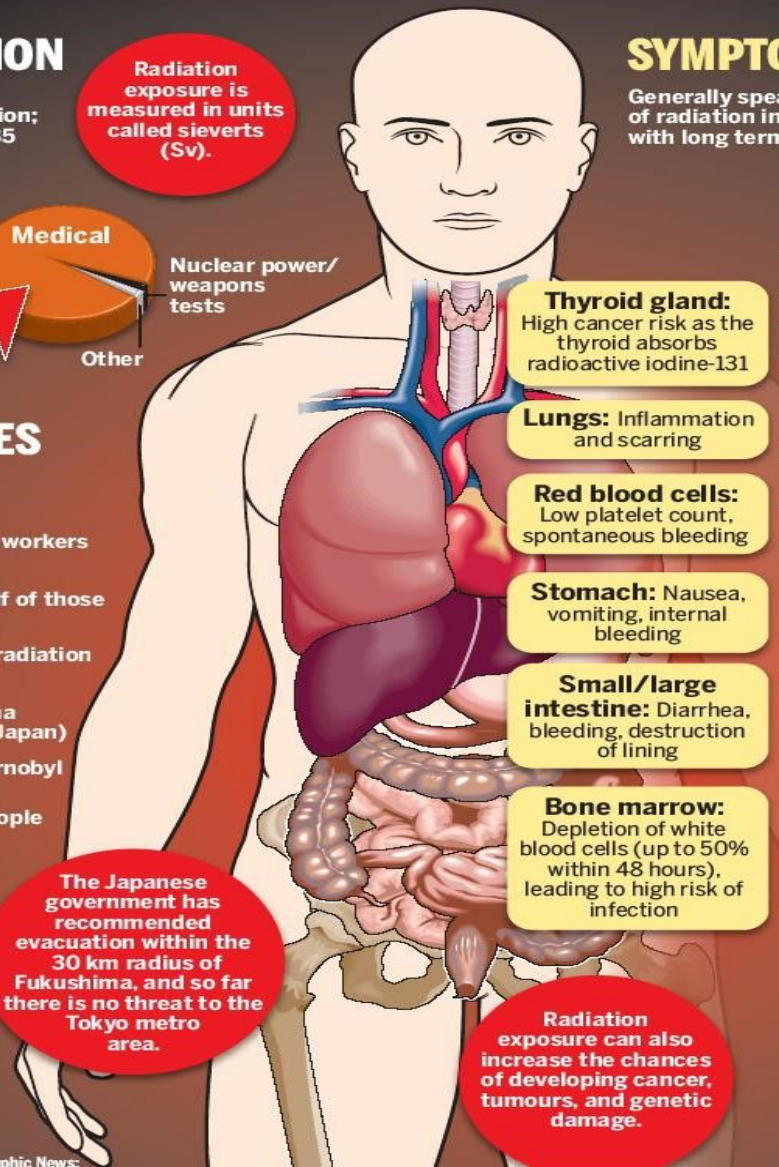
BACKGROUND RADIATION

Everybody is exposed to both naturally-occurring and artificial background radiation; levels typically range from 0.0015 – 0.0035 Sv/year:

Radiation exposure is measured in units called sieverts (Sv).

COMPARING EXPOSURES

10 Sv	Fatal within weeks
6	Typical levels in Chernobyl workers who died within a month
5	A single dose would kill half of those exposed within a month
1	A single dose could cause radiation sickness and nausea
0.4	Detected level at Fukushima (as of Tuesday morning in Japan)
0.35	Exposure of relocated Chernobyl residents
0.10	Recommended limit for people working with radiation every 5 years
0.01	Full-body CT scan
0.002	Typical natural radiation per year
0.0004	Mammogram x-ray
0.0001	Chest x-ray
0.00001	Dental x-ray



Thyroid gland: High cancer risk as the thyroid absorbs radioactive iodine-131

Lungs: Inflammation and scarring

Red blood cells: Low platelet count, spontaneous bleeding

Stomach: Nausea, vomiting, internal bleeding

Small/large intestine: Diarrhea, bleeding, destruction of lining

Bone marrow: Depletion of white blood cells (up to 50% within 48 hours), leading to high risk of infection

The Japanese government has recommended evacuation within the 30 km radius of Fukushima, and so far there is no threat to the Tokyo metro area.

Radiation exposure can also increase the chances of developing cancer, tumours, and genetic damage.

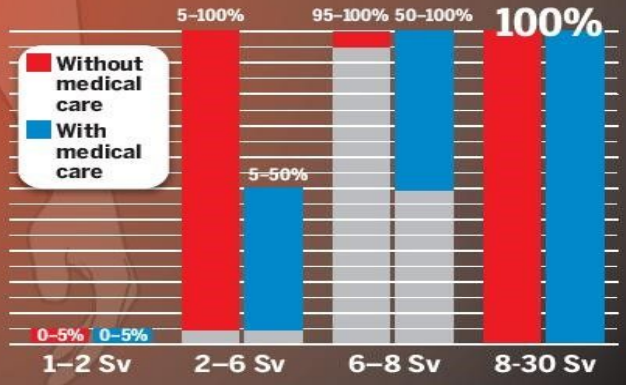
SYMPTOMS OF RADIATION EXPOSURE

Generally speaking, radiation sickness is brought on by a large dosage of radiation in a short period of time, but it has also occurred with long term exposure.

Early symptoms, exposure levels and time to symptom onset

	1–2 Sv	2–6 Sv	6–8 Sv	8–10 Sv
Nausea, vomiting	6 hrs.	2 hrs.	1 hr.	10 min.
Diarrhea	—	8 hrs.	3 hrs.	1 hr.
Headache	—	24 hrs.	4 hrs.	2 hrs.
Fever	—	3 hrs.	1 hr.	1 hr.
Later symptoms				
Dizziness, disorientation	—	—	1 wk.	Immediate
Weakness, fatigue	4 wks.	1–4 wks.	1 wk.	Immediate
Hair loss, bloody vomit and stools, infections, poor wound healing, low blood pressure	—	1–4 wks.	1 wk.	Immediate

CHANCES OF DEATH BASED ON EXPOSURE LEVEL



Sources: guardian.co.uk; World Nuclear Association; Wikipedia; Graphic News;

Brain: May cause seizures

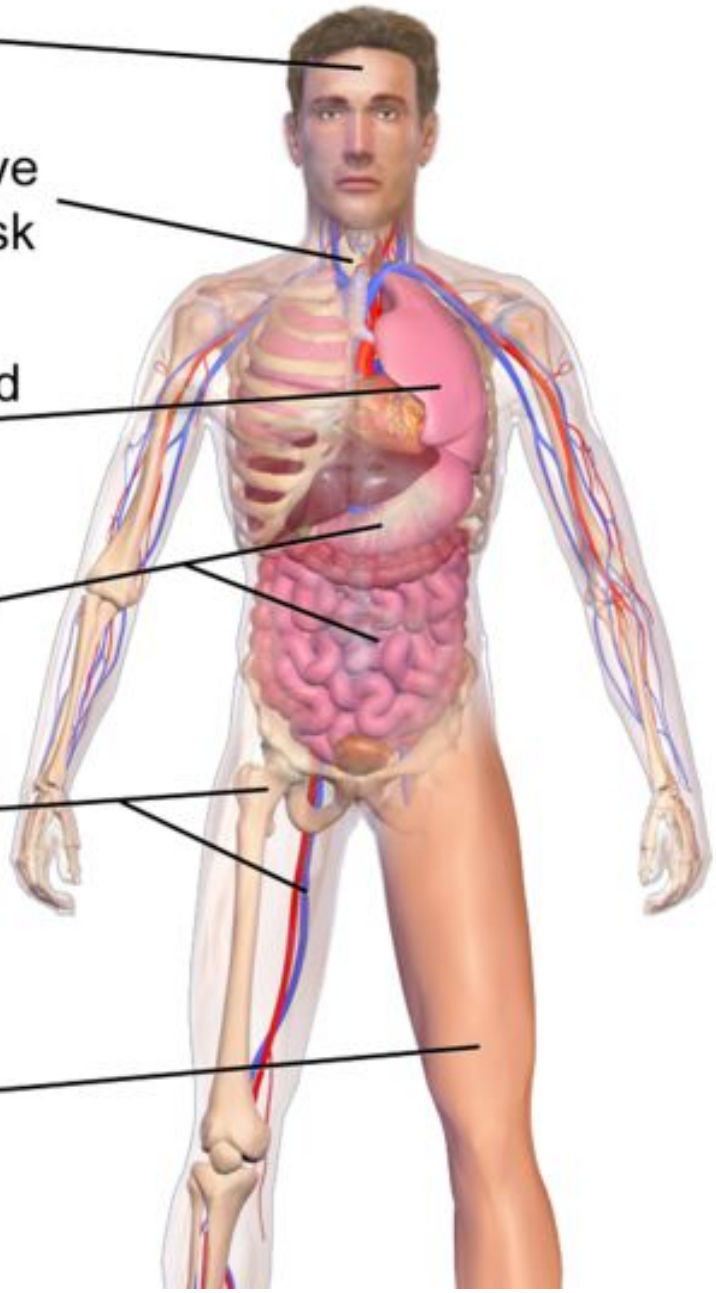
Thyroid gland: Absorbs radioactive iodine increasing thyroid cancer risk

Lungs: Inflammation, scarring, and possible cancer risk

GI Tract: Internal bleeding

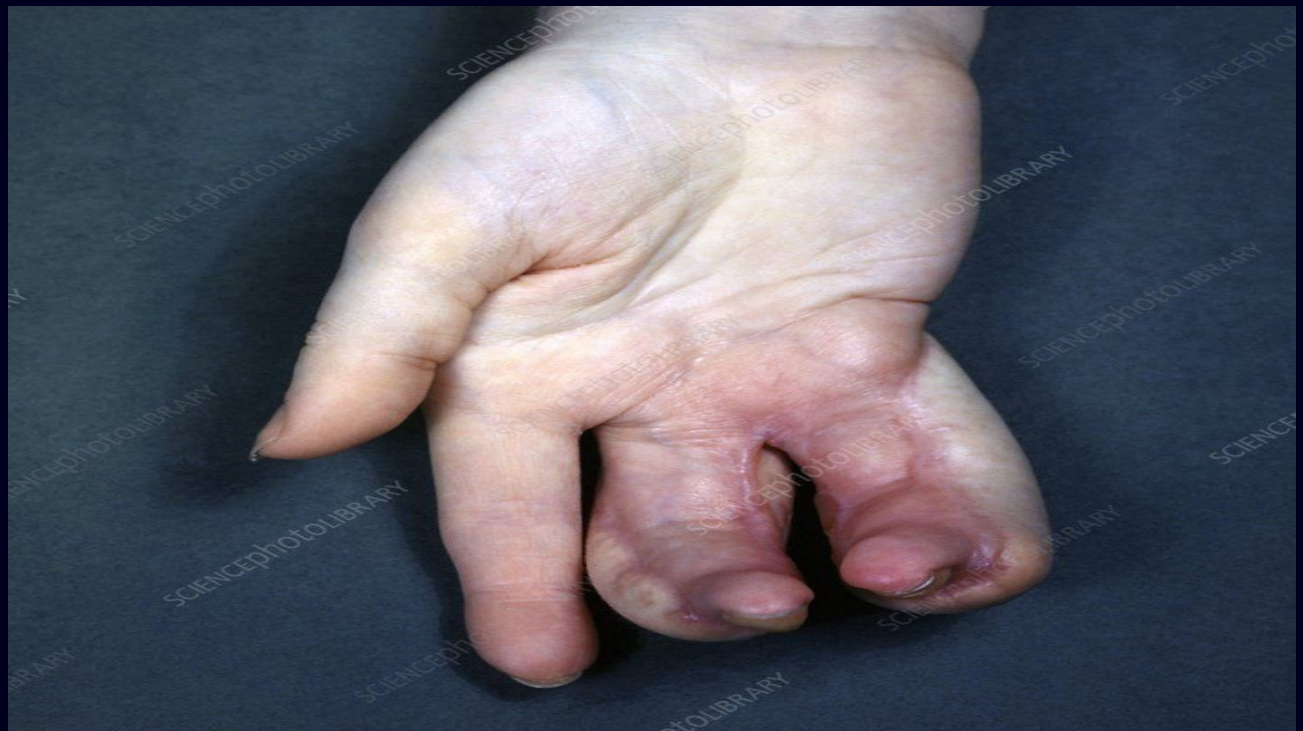
Bone marrow and blood vessels: Loss of white blood cells increasing risk of infection

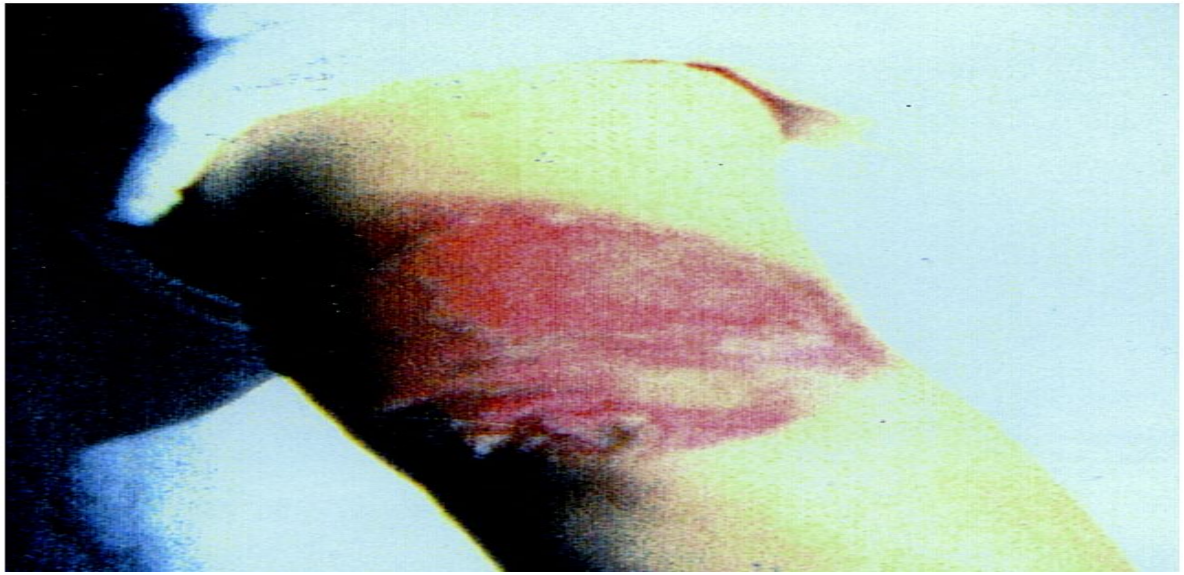
Skin: Burns from acute exposure



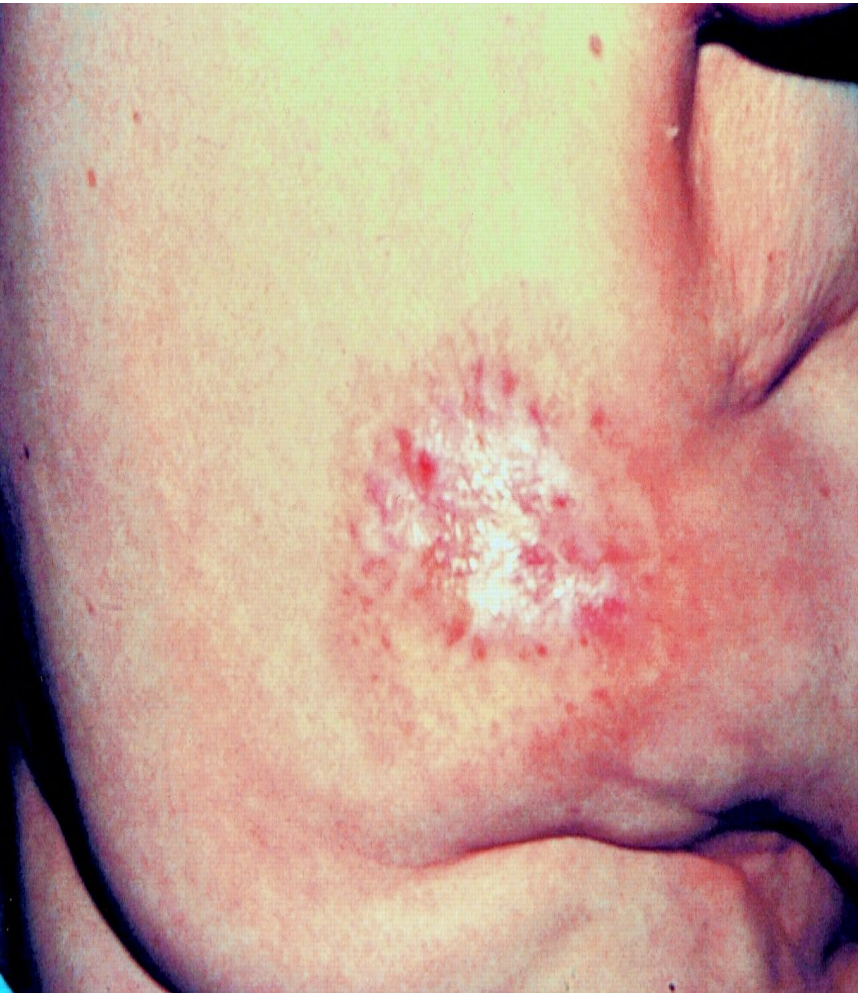
Radiation Effects

Deterministic: skin burns, cataract.
Stochastic: cancer, genetic mutation.
Cumulative exposure risk for both patient and operator.





49-year-old woman with 8-year history of refractory supraventricular tachycardia. Photographs show sharply demarcated erythema above right elbow at 3 weeks after radiofrequency cardiac catheter ablation, tissue necrosis 5 months after procedure .



75-year-old woman with 90% stenosis of right coronary artery. Photograph of right lateral chest obtained 10 months after percutaneous transluminal coronary angioplasty shows area of hyper- and hypopigmentation, skin atrophy, and telangiectasia (poikiloderma

Dose Optimization (ALARA)

As Low As Reasonably Achievable.
Use pulsed fluoroscopy, reduce frame rate.
Collimate beam to smallest area.

Personnel Protection

Lead apron (0.5 mm Pb), thyroid collar, lead glasses.
Stand ≥1 m from source.
Use ceiling-mounted shields.
Personal dosimetry monitoring monthly.

Patient Protection

Shield non-target areas.
Avoid prolonged fluoroscopy.
Document fluoroscopy time and DAP (dose area product).

Interventional Workflow Optimization

Pre-plan needle path before activation.
Use intermittent fluoroscopy instead of continuous mode.
Use non-imaging tasks to minimize exposure time.

CT-Guided Procedures Overview

CT provides superior visualization for deep structures.
However, delivers higher dose → only for specific indications.

Alternative Imaging Modalities

Ultrasound-guided procedures eliminate ionizing exposure.
Use for peripheral nerve blocks, musculoskeletal injections.

Radiation Safety Audit

Track cumulative exposure data.
Implement corrective measures for staff exceeding dose limits
Annual competency re-evaluation.

Ethical and Legal Aspects

Informed consent regarding radiation exposure.
Documentation of risks and adherence to safety policies.

Key Takeaways

Acute pain management must be proactive and evidence-based.
Radiation safety is a professional duty.
Integration of both ensures safe, effective patient care.

References

Raj PP: Pain Medicine Review, 4th ed.
Cousins MJ: Bridenbaugh’s Handbook, 5th ed.
IASP & WHO Guidelines, 2023.
European Pain Federation Safety Standards.