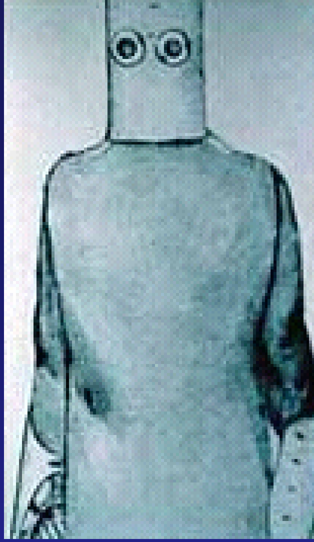


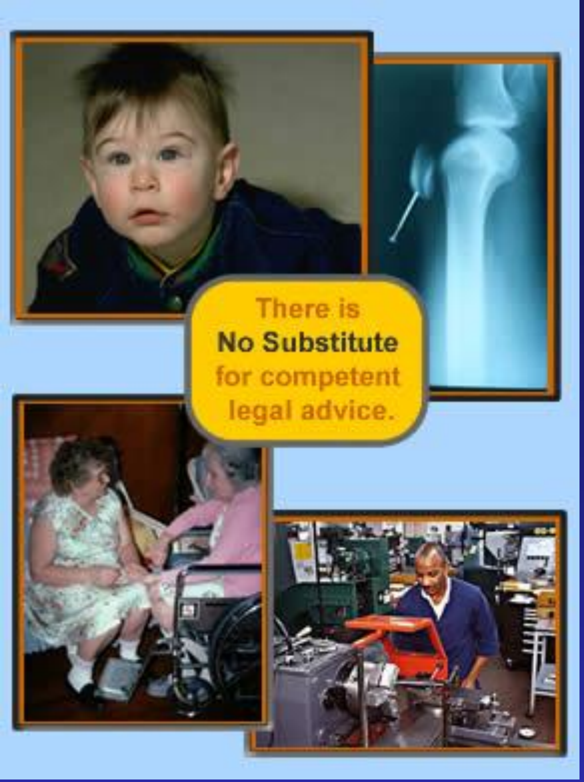
Medical Physicists and Malpractice: Accidents and Legal Matters

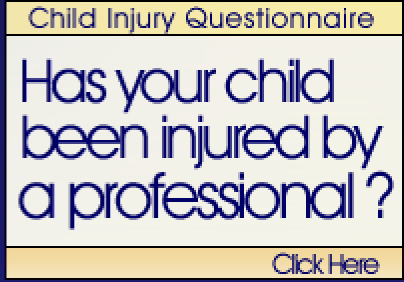
X Ulusal Medikal Fizik Kongrezi
01-04 Eyliil 2005, Erciyes Universitesi - Kayseri

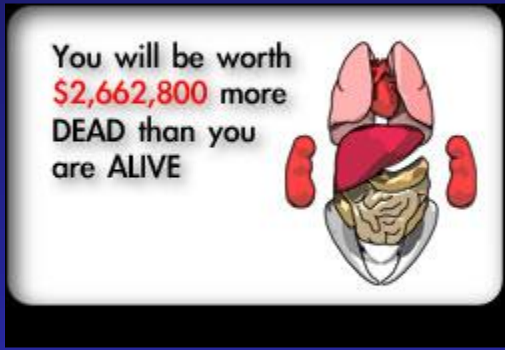
Constantin Kappas
University Hospital of Larissa
Larissa, Hellas (GR)

<u>note</u>: lawsuits for medical malpractice is becoming very common in the U.S.A.

Justly or unjustly, many patients or relatives refer to the court inculpating physicians or medical physicists for delayed diagnosis, overexposure to ionizing radiation, injuries etc.







During the last years, this phenomenon has started to spread in Europe and provoke trouble and anxiety to the medical world.

Nevertheless, this new situation presents also some advantages:

it stimulates specialists to:

- care better their patients,
- respect regulations and finally,
- raise the quality of their services.

The author does not pretend to be a specialist in malpractice and legal matters.

He considers that, he is concerned as any other radiation physicist involved in clinical practice;

this presentation could perhaps initiate a discussion on this crucial subject and on how quality assurance procedures could protect us from mistakes and malpractices.

The available literature is very limited (principally from the U.S.A.) and some interesting points are presented below (even if the legislation differs among countries, the general guidelines toward malpractice are the same).

A patient who believes that he or she has received improper medical treatment may be untitled to take legal action against those who administered that treatment.

Typically, all

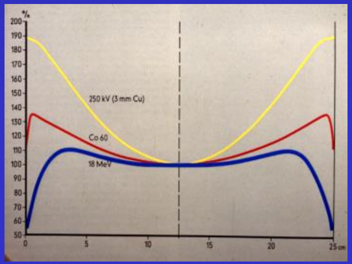
- Medical Personnel
- Hospitals
- Medical equipment providers

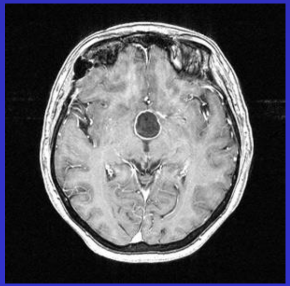
involved with the treatment, are named as defendants.

Radiation Physicists may be among the defendants named especially if:

"radiation dose" and
"imaging quality"

is an issue.





Report of the "Physician Insurers Association of America" (1995)

- 24% of all patients' claims and lawsuits were against diagnostic radiologists
- These claims correlated strongly with the increased use of mammography for breast cancer screening
- Average payment per case for "failure to early diagnosis of breast cancer": 301460 $ (claimants) + 28700 (costs, lawyers)

- 1992: 18452 claims for "medical malpractice" of all kinds. Of these:
  - 69,4% resolved in an agreed settlement
  - 23,7% had summary judgments, default judgments, dismissal or directed verdicts
  - 6,9% had trial verdicts

Types of Lawsuits

- Negligence
- Gross Negligence and Intentional Torts Resulting in Exemplary Damages
- Products Liability

- Negligence is a species of tort law based upon “fault”.
- “Fault” is a departure from a standard of conduct required of a person by society for the protection of others.

- "Fault" in a tort context is not necessarily morally blameworthy:

  e.g. the conduct of a medical doctor may not have been intended to cause harm to a patient, but nonetheless failed to meet an accepted standard of medical care

  (that standard is often referred to as the "reasonable medical doctor" standard).

The accepted standards of conduct changes with time:

Professional conduct on the part of a medical physicist that may have been excusable ignorance 15 years ago may be regarded as negligent ignorance today.

The following <u>four</u> elements are necessary to establish a claim of negligence:

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Two imperative requirements in order to justify a claim for "negligence"

1. In a jury trial, the jurors will decide whether all the elements of negligence have been proven by a preponderance of the evidence (greater than 50%) to be more likely than not.
2. If a plaintiff fails to prove one element of negligence, the plaintiff's case fails

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

- A tort based on negligence requires a duty owed to the plaintiff by the defendant.
- In practice, the duty issue presents little problem in radiation injury cases.
- The use of radiation is highly regulated and the regulations require that radiation be used in a safe manner.
- Consequently, it will be difficult for a defendant to successfully argue a "no duty" defense

- The law generally holds the medical physicist to the standard of care expected of a "reasonable" and "prudent" medical physicist exercising ordinary care under the same or similar circumstances .

- The law requires from medical physicists and specialist physicians such as radiologists and radiation oncologists to be held to national and international standard of care

1. Duty Defined by Standard of Care (con't)
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

- Standard of care: As year passes, the determination has evolved from a "customary" standard based on practices of similar medical professionals toward a more objective "good" standard.

A modern standard of care for medical professionals should be based on what:

- texts say (e.g. papers, books)
- professional schools teach (e.g. Medical or Physics School, M.Sc. in Medical Physics)
- other professional do in their practices
- various professional organizations or board recommend (ICRU, ICRP, ESTRO, EFOMP, …)
- the expert witnesses recommend
- the expert witnesses do in their own practice

1. Duty Defined by Standard of Care (con't)
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

A poor medical result, standing alone, is not a proof of negligence (e.g. if the Radiation Oncologist has acted "reasonably" and "prudentially")

Radiation Physicists I: If his or her judgment affects the care of a patient, the same type of general rule should apply to the physicist as to the physician .

Usually mistakes in radiation measurement or calculation that result in injury and damage to a patient will be found to be negligence <u>on the argument that a safety net should have been in place to discover errors</u>

1. Duty Defined by Standard of Care (con't)
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Radiation Physicists II: Even if

a) Duties are very heavy and the number of physicists in the department is not sufficient,
b) The hospital administration either does not provide the Medical Physics Department with the necessary quality control tools or does not permit to the medical physicist to handle some activities,

the Law charges the Medical Physicist with full responsibility and negligence if a patient damage occurs

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

The problems arise out of the necessity to create or adopt a legally sufficient standard by which to measure breach

The answer to the problem (in this highly regulated area) should be straightforward:
compliance or noncompliance with applicable government safety standards provides an excellent measure of breach.

- The quality of written documents such as scientific papers may also become an issue.
- However, the major contemporary documents of the recognized authorities such as ICRP, NCRP represent by far the best sources of guidance for the courts.

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Causation in tort cases is an unsettled legal area that may never be fully delineated by rules
(especially for late injury where no medical test exists that can determine that they were caused specifically by radiation)

Thus, the testimony of an expert witness might be sufficient to support a finding of causation if the expert stated that:

in his/her opinion *with reasonable medical probability* that the alleged conduct *more likely that not* was a cause of the harm.

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Example:

in the case of a missed lung cancer, the failure to diagnose the lung cancer was certainly not the cause of the cancer itself.

However the failure of a radiologist to diagnose a cancer or injury may cost the patient a chance at cure.

Public policy has given a legal response to this injustice referred as

lost chance due to delayed diagnosis.

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Poor quality images could be cited as a cause of a patient's injury in lawsuits. Today's performance-based standards may introduce new questions for the medical physicist:

- Is a poor-quality image
  - the result of an inadequate processor control program ?
  - the result of too few physics evaluations of equipment ?
  - the result of an inadequately trained technologist ?
- Is the physicist responsible overall for the imaging quality ?

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation (con't)
4. Damage (social, financial and health)

In Radiation Therapy:

- A 5-10% of the patients will develop radiation induced complications.
- Patients should accept this small probability of complications and not consider it as clinical injury.
- Concerning late effects, according to NCRP statement 7 (1992), it is clear that: "the clinical examination is not able to determine with absolute certainty, that an injury is caused by a certain radiation exposure".
- Nevertheless, after one year (1993) NCRP report 116 issues guidelines for patient radiation protection and includes for the first time the embryo radiation protection.
- Furthermore, in a quite interesting book (D. Gooden, "Radiation Injuries – Ionizing Radiation", Lawyers Coop. Publishing, New York) is pointed out that juries actually hate statistics and often this feeling is turned against medical personnel and hospitals....

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Proof of damage is an essential part of the plaintiff's case.

Damages cannot be recovered for torts where no actual loss has occurred.

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Damages recoverable by or on behalf of injured person:

- necessary medical expenses,
- loss of past and future earnings,
- cost of hiring assistant or home care attendants,
- pain and suffering from physical injuries or reasonably likely to occur in the future,
- mental anguish,
- harm from loss of sleep,
- sexual dysfunction, loss of sense of smell,
- past and future impairment of ability to enjoy life, …

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Damages recoverable by heirs or dependents of injured person:

- loss of consortium,
- loss of household services from killed or injured spouse,
- loss of financial support from decedent's earnings and other income,
- loss of parental advice and guidance,
- loss of companionship of decedent,
- funeral and burial expenses,
- mental anguish and grief of survivors, …

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

Additional elements of damages:

- damages for injury to real property,
- litigation fees and costs, …

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

The following facts are circumstances which can be used to show that a person has suffered an injury due to exposure to ionizing radiation:

Exposure to radiation source:

- nature of radiation source,
- measurements of level of exposure,
- proximity to radiation source,
- duration of exposure,
- exposure exceeded applicable regulatory standards,
- effectiveness of shielding, …

1. Duty Defined by Standard of Care
2. Breach of Duty
3. Injury and Causation
4. Damage (social, financial and health)

The following facts are circumstances which can be used to show that a person has suffered an injury due to exposure to ionizing radiation:

Injury:

- acute radiation injury (erythema or reddening of skin, wounds or open sores, damage to internal organs, death within accepted period following exposure),
- late radiation injury (cancer or leukemia, mutagenic and teratogenic effects).

Gross Negligence “signifies:

- more than ordinary inattention, but
- less perhaps than conscious indifference to the consequences”.

Attention! Physicists and physicians should be very concerned when gross negligence is plead in any lawsuit because *malpractice* insurance may not cover awards of exemplary damages

- Today (under negligence law) all persons are required to pay ordinary care to prevent others from being injured as a result of their product.

Hospitals against medical equipment Companies:

The plaintiff (hospital) must prove only that:

1. the product was legally sold,
2. the product has reached the user without change,
3. the product was defective in design, manufacturing, or lack of warnings in order to render the product defective and unreasonably dangerous as perceived by an ordinary person or user,
4. there were injuries and damages caused by the defect.

Very often, the functionality of a device (e.g. treatment planning system) is a confused matter:

The company could prove that although the product is defective (e.g. wrong calculation of isodose chart, which was not understood by the radiation physicist during the commissioning) but

"if the radiation physicist has done the appropriate test and quality controls, according to the national or international protocol X, he or she could discover the defection...."

Time limit for a lawsuit:

an injury caused by medical malpractice might not be discovered for months or even years after the original negligence.

Some countries have doctrines in place for malpractice torts that cause the statute of limitations to start running:

a. once the negligent injury is, or
b. should have been discovered by the plaintiff.

Medical Physicists as expert witnesses

Medical Physicists may appear in court as expert witnesses, particularly in medical malpractice cases where radiation dose is an issue.

However, the testimony of medical physicists often pertains to radiation dose and usually does not include hypothetical questions.

In a malpractice case in which a physician is the defendant, physicists may be allowed to testify

on the medical standard of care

if they have adequate experience in the area to qualify as experts.

Records of Regularly Conducted Activity:

To indicate trustworthiness, medical and physics records, such as radiation machine calibrations or tests of imaging quality should be orderly and in ink or printed.

If records are handwritten:
recording in a bound book enhances the reliability of the record dates.

Measurements on a phantom

Evidence from experiments conducted outside the courtroom is often admissible if the experiments are demonstrated to be relevant to the case.

For example,
measurements could be made on a phantom, simulating the treatment of a particular patient.

If after a suit was initiated a medical physicist

- purchased a new imaging phantom for diagnostic radiology or
- subscribed to a service for testing radiation machine calibration by mailed dosimeters,

this information could not be used to prove that the prior methods were negligent.

A medical physicist who has confidential information about a patient

should treat the information with the same regard as required of a physician

If the duty of a medical physicist arises from the physician-patient relationship or the hospital relationship, the physician or hospital would likely also be a defendant

if the medical physicist is accused of negligence in a malpractice action

The duty of a medical physicist to a patient is not explicitly developed in case law.

Most, and possibly all, medical physicists believe they have a duty to patients

Patients who are aware of the activities of medical physicists probably also believe that medical physicists have a duty to them.

Courts find that medical physicists have a duty to patients whether that duty is derivative from:

- a physician-patient relationship,
- a hospital-patient relationship, or
- if those relationships are not applicable, arises independently from a generalized tort theory developed for the case in hand

Prevent Harm to a Patient:

A medical physicist has a responsibility to call attention to anything, including orders of physicians that may harm a patient.

If a dispute with a prescribing or ordering physician cannot be resolved, a physicist may be obliged to take the question to a higher authority.

If there is no higher authority, the physicist may provide some self-protection by putting the concerns in writing to the physician.

A frequent case is that a dispute, concerning a planned procedure, is occurred and the physicist thinks that a medical mistake is about to be made.

If the physician continues in the treatment, the physicist has a duty to protect his employer from liability by informing the appropriate person.

Legal need for Revealing Own Errors:

Many medical physicists have discovered their own errors:

a. relate to a patient under treatment (correctable) or
b. systematic error (that has affected previous patients)

What is the physicist’s ethical and legal responsibility ?

If the medical physicist is unwilling to reveal past physics errors, the skill of the radiation oncologist may be undermined in treating new patients because of a faulty association of dose prescriptions and the expected clinical result.

The temptation of a physicist to correct physics errors without bringing those errors to clinical attention could result in future patients receiving more or less treatment than optimum within the experience of the radiation oncologist.

Clearly the medical physicist is under an ethical obligation to reveal his or her own or another’s errors.

Ownership of Records:

Records of measurements are part of the physicist's work product and those records are the property of the employer (e.g. hospital).

The employer has a legal duty to maintain them as patient care records.

The removal of physics records can leave an incoming physicist and the institution in a crippled position clinically and legally with regard to previously treated patients.

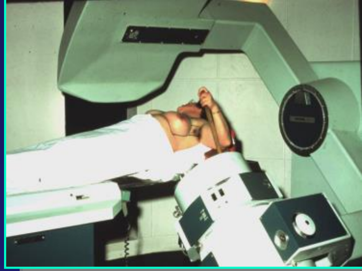
Preserve Records after an Incident:

It is uncommon for records to be altered or destroyed by physicians, physicists or hospital employee who wish to protect themselves,

but it does happen!

Efforts to alter or destroy records usually harm the defendant's case (falsified or lost records are damning in court).

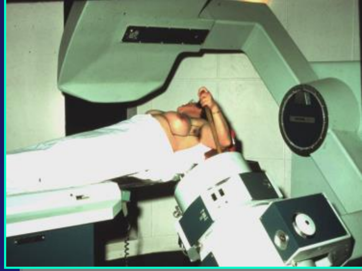
The integrity of records should be ensured by copying or other precautions.



Incorrect Decay of Cobalt-60 source and falsification of records

Events :

- A Cobalt-60 unit calibrated correctly initially was incorrectly decayed without remeasurement of the output.
- The fulfillment of patient radiation prescriptions increased progressively to 10% overdose in 5.5 months and then to 50% overdose in the subsequent 16.5 months.
- During the latter period, 426 patients were treated.
- In 183 patients who survived beyond one year, there were 34% with severe complications in various sites.
- About 242 lawsuits were filed; all but one was settled out of court.



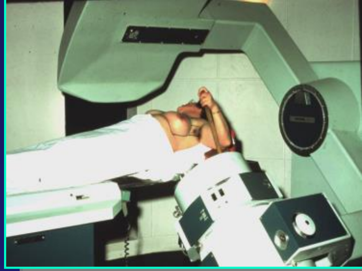
Incorrect Decay of Cobalt-60 source and falsification of records

Events:

- Initial blame: a faulty measuring system ?
- Local physicist: produced 10 calibration documents that supported the machine output used clinically the period in question

Consultant physicists were called in to review the events. They established:

1. The cobalt unit was functioning correctly during the 22 month period in question.
2. The institution's ionization chamber and electrometer were operating correctly during the 22 month period.
3. Five of the 10 calibration documents used atmospheric pressures that did not occur on the date stated.

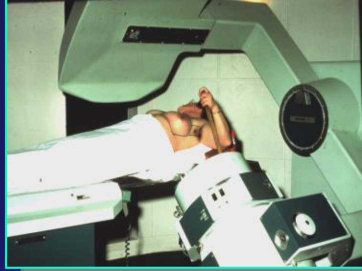


Incorrect Decay of Cobalt-60 source and falsification of records

Fraud:

<u>After the consultant physicists report the local physicist stated that:</u>

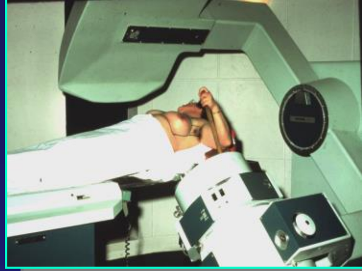
1. all but one of the reported calibrations with the cobalt unit had not been done and,
2. the calibration documentation had been generated without measurements!



Incorrect Decay of Cobalt-60 source and falsification of records

Physics comments:

1. Calibration of the cobalt machine at reasonable intervals would have been helpful.
2. Mailed dosimeter checks would have revealed the problem sooner.
3. A weekly check of machine output would have revealed the problem promptly.
4. QA guidelines and national legislations recommend protecting records. The local physicist falsified records.



Incorrect Decay of Cobalt-60 source and falsification of records

Legal comments: *Consider the elements of negligence*

1. Duty: An ordinary, prudent physicist should satisfy all four conditions presented above (physics comments).
2. Breach of duty: The local physicist breached this standard of care.
3. Injuries (as a result of breach): Depending upon the dose prescription, arguments can be made to show that for treatment at many sites, patients can tolerate 15% or more radiation dose than that prescribed without injury and damage, at other sites 15% overdose may not be tolerated.
4. Damage to the patient: could be demonstrated easily for the patients who had received large overdoses.

Design Error in a Linear Accelerator

Events:

- An initial instruction for 25 MV X-rays was changed to an electron beam instruction before the computer verification process for the first instruction was completed (about 20 sec)
- The machine displayed the electron mode on the monitor in its usual format but operated partly from x-ray instructions and partly from electron instructions.
- The combination of operating parameters resulted in a high-beam current, unscanned 25 MeV electron beam with a diameter of about 5.5 cm at a depth of 2-3 cm.
- The machine recognized the high dose rate (in the monitor chamber) and turned the machine off within a second or so.
- In that short time a dose of 164 Gy (one hundred sixty four Grays!) was delivered by electrons at the depth of maximum dose.

Design Error in a Linear Accelerator

The wrong parameters took place in the treatment of two patients:

first patient

- He was being treated in the upper back area with 20 MeV electrons using a 10x17 cm2 field.
- During a treatment in the second week the patient jumbed up and said he felt as if he had received an electric shock and felt hot coffee poured on his back.
- The patient experienced vomiting and later, paralysis in the legs and elsewhere.
- He died five months later.

Design Error in a Linear Accelerator

The wrong parameters took place in the treatment of two patients:

second patient (three weeks later…)

- He was being treated on the side of the face with 10 Mev electrons to a field of about 7x10 cm2.
- The machine acted in the same manner as it had three weeks earlier.
- The patient said that he felt that he had been hit on the side of the face, saw a flash of light, and felt as though there had been fire on his face.
- The patient died three weeks later.

Design Error in a Linear Accelerator

Physics comments:

No practice of quality assurance would have uncovered this possibility of machine performance

Design Error in a Linear Accelerator

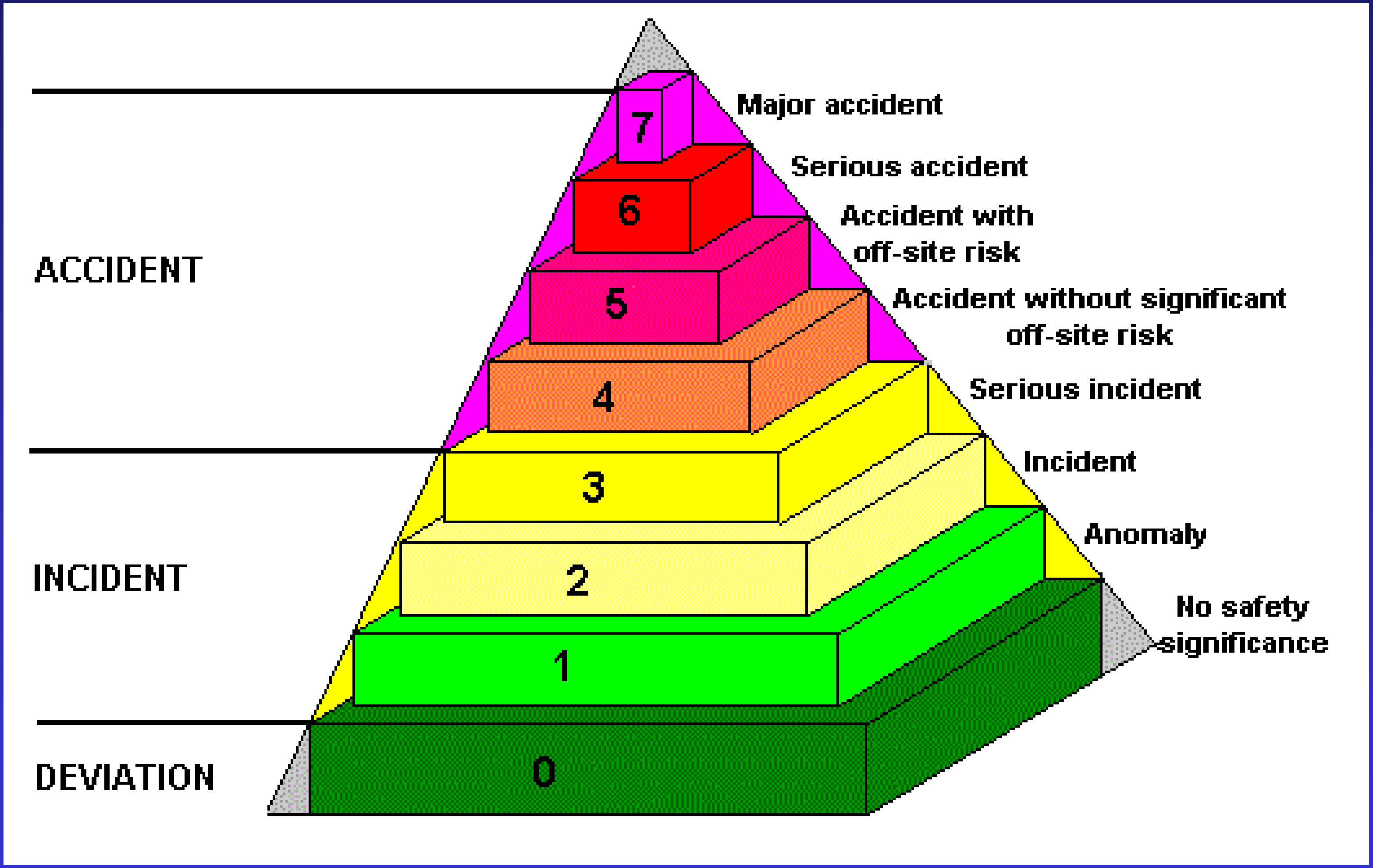
Legal comments:

1. The radiation professionals on site were not negligent in the event described.
2. The physicist on site could not be expected to discover the design fault without a prompting incident.

<u>The legal theory of strict (product) liability, however, would apply:</u>

1. the seller was engaged in selling such a product
2. the product was used without change in the condition in which it was sold
3. the product was unreasonably dangerous to the user or consumer (it apparently had a design fault)

CLASSIFICATION OF ACCIDENTS



Events related to equipment which affect many patients simultaneously

Stage in which the event took place (chronological order)	**Events %**
Dosimetry System: Ion-chambers and electrometers	**11**
Calibration of dosimetry reference system	2
Comparison with the secondary system	2
Daily use	7
Therapy Units	**56**
Commissioning	14
Calibration (yearly)	7
Constancy Control (daily, weekly)	2
Unit malfunction	20
Wrong Use	13
Simulator	**7**
Unit malfunction	7
Treatment Planning System	**26**
Commissioning and input of basic dosimetric data	12
Daily use	14

Events related to equipment which affect a particular patient

Stage in which the event took place (chronological order)	Events %
Dose prescription	
Wrong dose reporting	19
Errors in image process	9
Treatment Planning	
Reporting	4
MU or Time Calculation	9
Wrong use of the TPS	12
Therapy Process	
Patient Identification	6
Reporting of patient set up	30
Wrong use of therapy unit	7
Final Control of Treatment Completion	4

Events related to equipment which affect many patients simultaneously

Stage in which the event took place (chronological order)	**Events %**
Source Strength Verification	34
Uniformity Check in a series of radioactive source	18
Landmarks Verification	12
Storage and Reporting of Radioactive Sources	18
Leakage Control	6
Applicators: Commissioning and Maintenance	12

Events related to equipment which affect a particular patient

Stage in which the event took place (chronological order)	**Events %**
Dose prescription and reporting	3
Reporting including activity, anatomical site, dose rate and treatment time	18
Patient Identification	3
Informing patients	9
Reporting and Filing	9
X-Rays localisation of radioactive sources	6
Correct Placement of Radioactive Sources	23
Radiation Sources Identification	11
Final dose calculation and irradiation time	3
Correct Dose Delivery	9
Correct Treatment Time	3
Patient Follow Up after sources removal	3

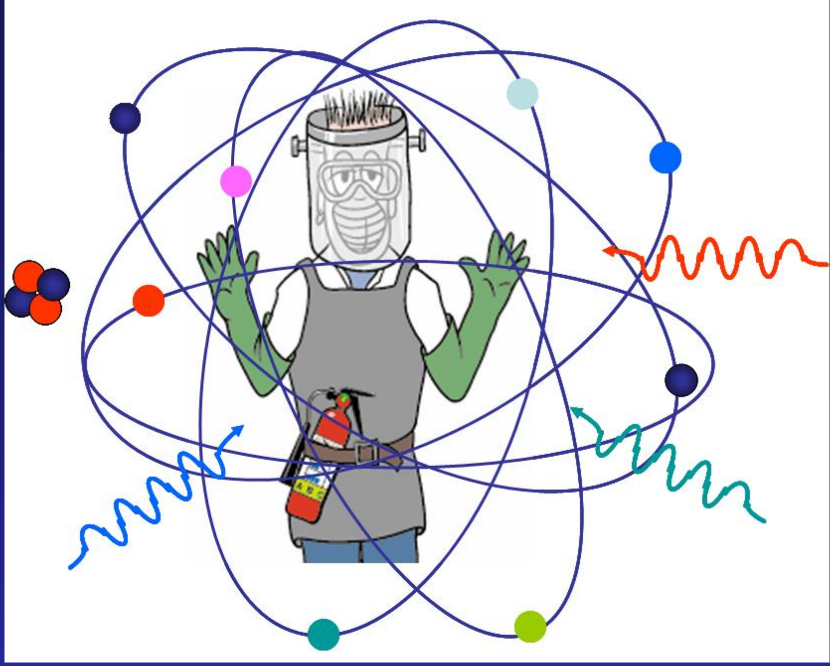
HDR Brachytherapy

Events related to equipment which affect many patients simultaneously

Stage in which the event took place (chronological order)	**Events %**
Personnel Training	40
Equipment Malfunction	60

Use of Unsealed Sources

Stage in which the event took place (chronological order)	**Events %**
Treatment Planning and Equipment Availability	40
Dose administration	50
Security and Contamination	10



The QA principles suggested below are meant to be broad, commonsense recommendations that support an attitude of continuing attention and of challenge to the correctness of medical use of radiation in diagnosis and therapy.

Consulting physicists must pay particular attention to communication issues because they may not be present when unusual events occur

- Responsibilities and authority of various persons involved with radiation medicine should be defined clearly.

- Medical physicists should perform to national standards even though their employers may not expect it or do not allow them sufficient time to implement the standards.

- Supervisors should strive to develop an atmosphere of confidence and trust that encourages all persons to challenge procedures that may harm patients and to make their own errors known.

- A physician should be designated to be informed about embryo or fetal irradiation and to counsel pregnant patients and pregnant radiation workers who have received or may receive radiation to the fetus.

- Pertinent records should be retained for a period of time at least as long as the longest statute of limitations for medical malpractice or for a period of time that other patient records are retained.

- Appropriate redundancy shall be used to ensure that
    - chamber calibration factors,
    - atmospheric pressure corrections,
    - wedge factors,
    - transmission factors for each radiation shield, and
    - other factors used in measurements and calculations

  are correct

- Radiation beams shall be calibrated with review by a second person at reasonable intervals, not to exceed one year.

- Independent checks of beam calibrations at an Institution shall be performed on-site or by mailed dosimeters at reasonable intervals *by individuals and equipment independent of the Institution*

- Regular checks shall be made to ensure that machines are operated in the same way during calibration and during treatment.
- The physical and electrical safety of patients undergoing treatment shall be reviewed at reasonable intervals.
- Only written radiation prescriptions shall be filled.
- There should be a departmental policy concerning the maximum radiation dose allowed to various healthy organs for conventional treatments. If higher doses to healthy organs are intended, they shall be specifically prescribed by the radiation oncologist.

- A manual, calculated check of dose should be made to at least one point in each computer-generated treatment plan.
- An independent check of treatment plans shall be made by a second person.
- For external beam treatments verification of machine settings by a second person acting independently or by passive monitoring of exposure time or monitor units by an automatic device shall be done.
- There shall be a weekly review of the accumulating patient dose in external-beam therapy.
- Even minor changes in successful techniques shall be challenged for new hazards.

- The identity of the patient and the strength of brachytherapy sources or unsealed radioactive nuclides used in radiation therapy shall be verified by a second person before fulfillment of a dose prescription.
- Patients shall be surveyed with a radiation detector after removal of brachytherapy sources.
- If an inconsistency is found in a treatment prescription, measurement, calculation, or functioning of a machine, that inconsistency shall be understood and resolved before proceeding with patient treatment.
- In the event of a misadministration of radiation treatment, the department head or a designee shall be informed promptly.

- Patient and physics records shall be protected, especially if a misadministration of radiation treatment has occurred.
- Detailed records of the performance and maintenance of radiation machines shall be maintained.
- Mechanical or electrical modifications of radiation machines shall be made only by the manufacturers or with the written approval of the manufacturer.

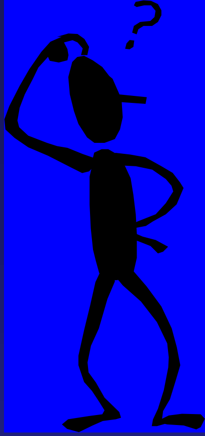
- Malfunctioning radiation therapy machines shall not be repaired before a designated, responsible person is informed.
- A malfunctioning radiation therapy machine or incorrect use of a machine shall not be repaired or corrected before the dosimetric consequences of the events are investigated and recorded.
- After any machine repair a radiation output check shall be made.
- Before dosimetry methods are changed, the radiation oncologist shall be informed (e.g. inhomogeneity calculations).

- Test the imaging capability of equipment by appropriate tests with comparison to recommended national standards.
- Know and follow *national regulations and QA guidelines* relating to licensing for ordering, possessing, testing, storing, labeling, posting warnings for, disposing of, and surveying for radioactive materials.
- The suitability of radiopharmaceuticals, including radionuclide identity, quantity, quality, chemical purity, toxicity, sterility, and apyrogenicity, should be tested on site. If this is not possible, they should be reviewed in light of the provider's warranties and assurances.
- Review of procedures for handling patients with therapeutic doses of radiopharmaceuticals should occur before each such event.

- The imaging capability of equipment should be tested by appropriate tests with comparison to recommended national standards.

- Know and observe regulations and recommendations for limiting radiation to patients undergoing diagnostic radiology. For procedures that do not have guidelines keep radiation quantities as low as is reasonably consistent with imaging quality.

- For a pregnant patient who has received radiation to the pelvic region measure or calculate the fetal dose.



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Epilogue I

In most radiotherapy installations, the physicist is the only person who can trace the entire chain of events

from the care of measuring instruments through machine or source calibration and radiation distributions to a statement of dose delivered to a patient.

Because in fact, this responsibility rests directly or indirectly upon the physicist, the physicist should openly take credit or blame for the correctness of dose fulfillment.

The importance of this function in effective therapy and in avoiding malpractice lawsuits should be made clear to management.

Epilogue II

Taking responsibility is the mark of a professional,

as opposed to a technician,
who may do complex functions but often
does not take responsibilities for the result.

A professional who accepts responsibility
does not have an excuse for not fulfilling that responsibility.

Overwork or lack of equipment
are not excuses for failure to uphold a responsibility.

A professional should define the conditions under which
he or she will accept responsibility.

The benefits of a professional
are more related to the responsibilities taken
than to the hours worked and the technical complexity of that work

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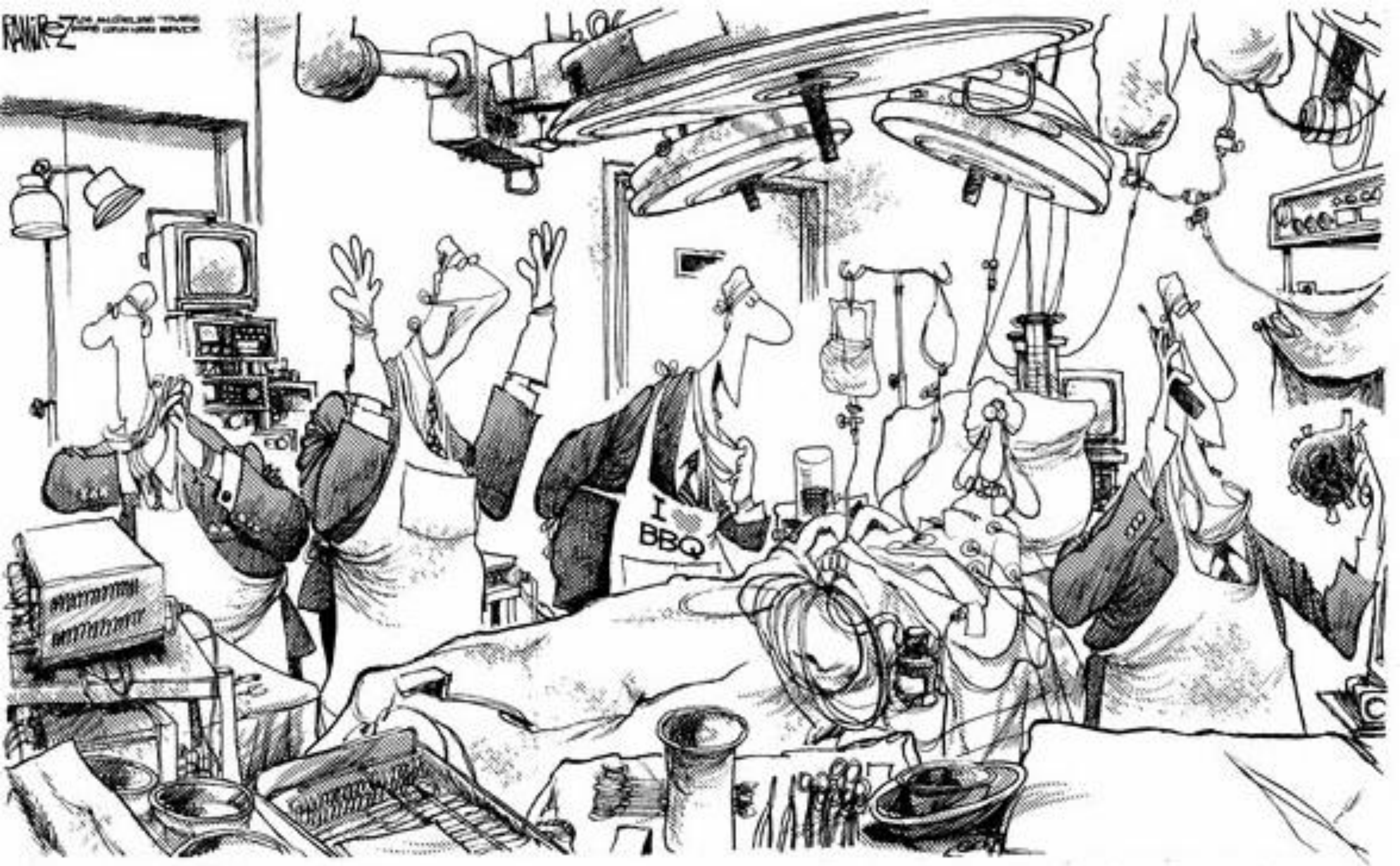
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