# Programmed Learning Manual for Artifact Identification*

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**Nuclear instrumentation, being highly sophisticated and complex, has been known to malfunction and technologists, being human, are apt to make technical errors while operating such instruments. Such malfunctions and technical errors have a definite effect on the CRT which shows up as a rather unique artifactual appearance on the imaging film. In many institutions these films are discarded or placed in a drawer once the cause of the artifact has been found. We have found it advantageous to collect these films and place them in a programmed learning manual. Students, technologists, and physicians find this manual quite useful in training and for future reference when artifacts appear during imaging.**

The preparation of a simple programmed learning manual comprised of scintiphoto artifacts has been useful in maintaining efficiency in our nuclear medicine department. The program style introduces artifacts to students prior to clinical experience, thus allowing them to develop a critical analysis of scintiphotos. Technologists and other nuclear medicine personnel may also use it to familiarize themselves with various scintiphoto artifacts.

## Materials and Methods

Scintiphoto artifacts are collected and categorized

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**TABLE 1. Artifact Sections**

| Section 1 Mechanical | Section 1 (*continued*) | Section 2 Technical | Section 3 Film processing | Section 4 Miscellaneous |
|---|---|---|---|---|
| I. Uniformity | 2. Bright spots | I. Double exposures | I. Mechanical transport | I. Patient movement |
| A. Calibration source | 3. Shifting position | II. Attenuation | A. Scratches | II. Positioning |
| 1. Positioning | 4. Fluctuating intensity | A. From patient anatomy | B. Static | III. Miscellaneous movement |
| 2. Activity | 5. CRT curvature | B. Foreign objects | C. Light leaks | IV. Residual activity in patient |
| 3. Photo peak | D. Photographic camera shift in position | III. Contamination | D. Polaroid | V. Shielding |
| B. Sheet source | E. Aging | A. Patients' excreta | E. Open view ports | |
| 1. Air bubbles | IV. Instrument setup | B. Infiltration | II. Processor artifacts | |
| 2. Comparison of sheet and point source | A. Intensity | C. Personnel contamination | A. Contaminated solutions | |
| C. Edge packing | B. CRT focus | D. NG and iv tubing | B. Solution temperatures | |
| D. Cracked crystal | C. Orientation | | C. Washing | |
| II. Collimation | D. F-stop settings | | D. Dryer temperature | |
| A. Correct collimator for isotope energy | E. Focal length | | | |
| B. Comparison of collimators | F. Pulse height analyzer | | | |
| C. Distance effect | G. Magnification | | | |
| D. Orientation differences | H. Analog vs. digital | | | |
| E. Collimation variation | I. Reticule illumination | | | |
| III. Mechanical failure | V. Resolution | | | |
| A. Power loss | A. Image size | | | |
| B. Detector set on divide | B. Phantom studies | | | |
| C. CRT defects | C. Distance effects | | | |
| 1. Half images | D. Patient positioning | | | |
| | E. Collimator differences | | | |

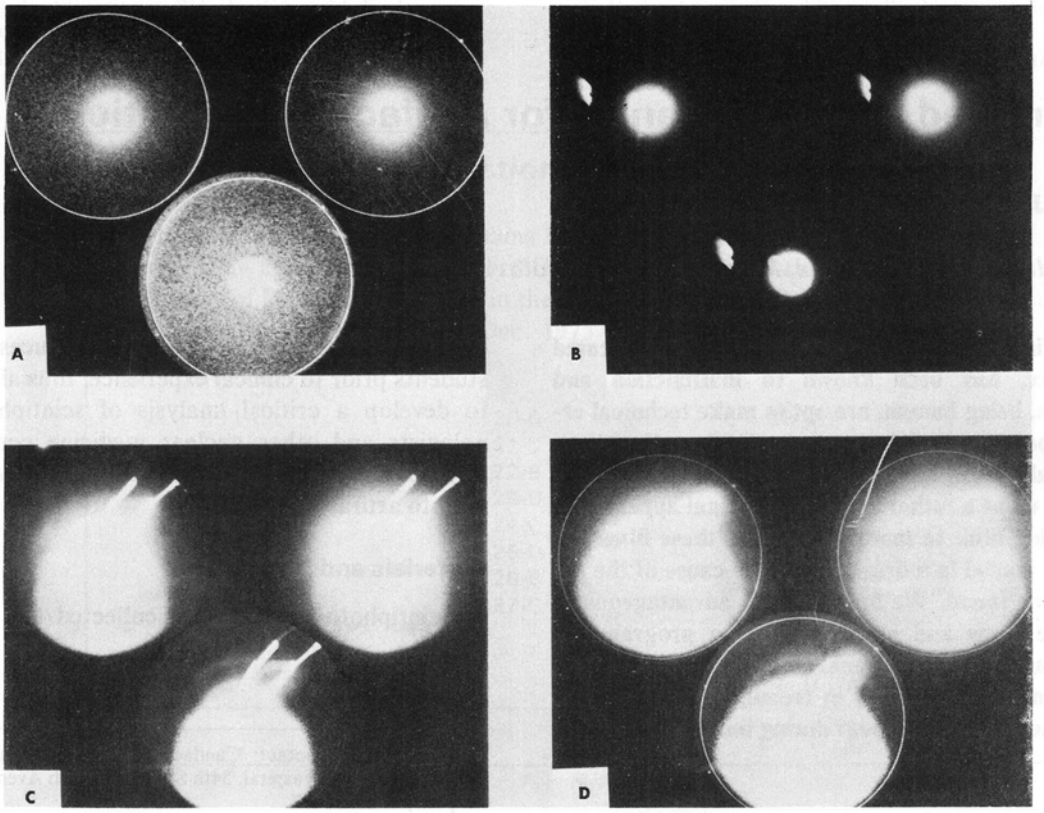


**FIG. 1.** (A)–(D) Typical images showing effect of voltage drop on CRT.

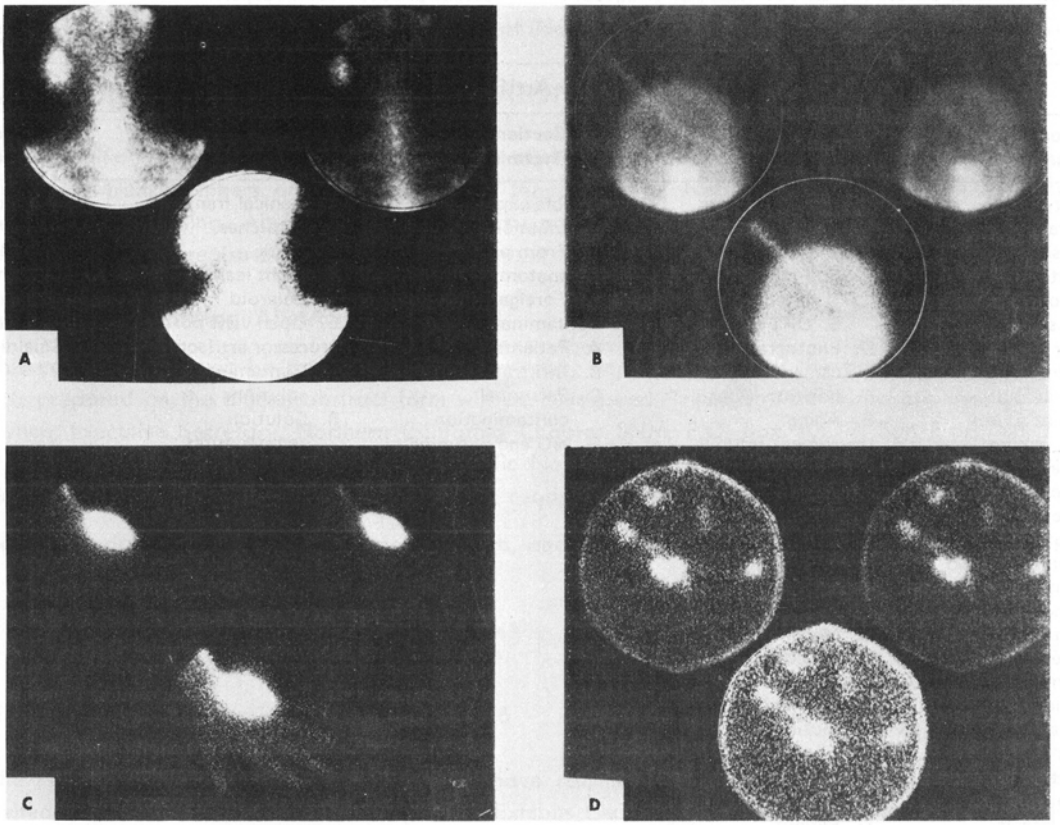


**Fig. 2.** (A) Contamination presents "hot potato syndrome"; contaminated pillow from patient's salivary secretions is culprit. (B) Contamination—activity in gastric secretion backing up in nasal gastric tube; solution—remove tube from area of interest. (C) Infiltration—patient usually must be reinjected. (D) Contaminated technologist's hands; solution—use of gloves would be in order here.

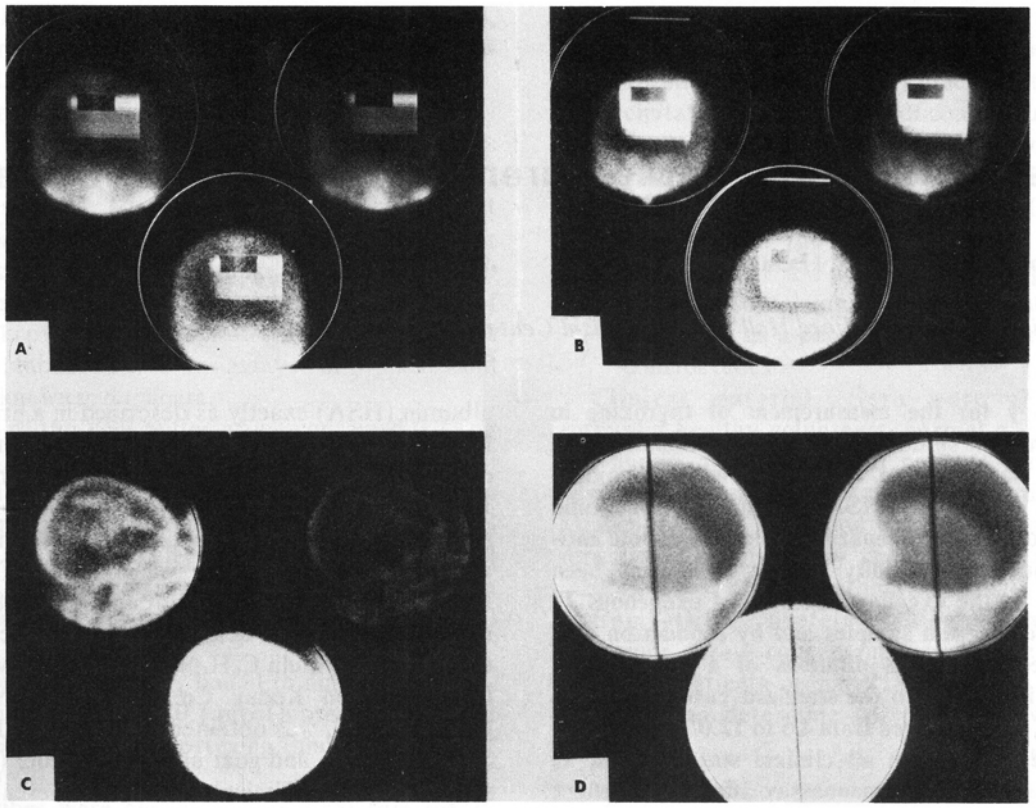


**FIG. 3.** (A), (B) Double-exposure spectrum on image. Solution—be sure film slide is in place while displaying spectrum. If in doubt about any unwanted image on film, discard it. Cost of this is insignificant when it involves complicated diagnostic decision. (C) Double exposure, skull and shoulder superimposed. Solution—pull or advance film after each image completion. Do immediately! Maintain consistency in routine. (D) *Triple Whammy*—patient's skull, detector set on divide, and point source activity from calibration of a persistence scope. Solution—take time to program instrument and avoid disruption of basic routine.

under appropriate categories for easy reference (Table 1). This collection establishes criteria for identification of artifacts and utilizes the artifacts to develop an understanding of the cause of their production.

The scintiphotos are placed in plastic film holders in a standard size three-ring binder allowing easy access, addition, and removal. Each page of the manual consists of four scintiphotos with artifacts labeled A,B,C, and D. A description of the artifact, its cause, and prevention are listed corresponding to the letter labeling the scintiphoto on the reverse side of each page. Instructions, terminology, references, test pages, and index are included in the manual. The examples of the pages in the manual are shown in Figs. 1–3. Some pages may demonstrate only one point of interest, while others demonstrate several. Corrected scintiphotos may accompany some categories. Certain categories, listed in Table 1, are rather arbitrary; some artifacts fall under more than one category.

New instruments are constantly being developed, each with its own particular mode of operation and subject to malfunctions which might subsequently produce an artifactual appearance on the scintiphoto. The manual is designed to allow for this constant change in instrumentation and the proliferation of artifacts that accompany it.

## Results and Discussion

The objective of the manual is to provide one with the awareness of the wide spectrum of artifacts possible. Part of this objective is to emphasize that the technologist must be able to identify an artifact, assay the factors or events which produce the artifact, make decisions about the cause of the artifact, and correct the cause of the artifact in an effort to maintain daily quality in imaging.

The manual provides a readily available reference source for artifacts, and establishes criteria for identification and develops and understanding of the diversity of the artifacts. Preparation of the manual is simple, inexpensive, and takes little time. It is also useful as a review for technologists, physicians, and students. A nuclear medicine department may improve its service to the patients by maintaining a similar program.

It is recommended that all nuclear medicine departments make an effort to exchange artifacts and offer comments on them. In this way, although the problem of artifacts may not be overcome, at least technologists could recognize the unique artifactual appearance and be able to rectify the problem through their familiarity with such a programmed learning manual.