I. GENERAL RADIOLOGY

by Andrew Koch, M. D.

To better appreciate the history of radiology in Lancaster County it is useful to review both the history of radiology itself as well as its major professional organizations.

In November of 1895 Wilhelm Conrad Roentgen, the Chairman of the Physics Department at the University of Wurzburg, Germany, was investigating the external effects from various types of vacuum tube equipment when an electrical current passed through them. He had a number of different types of vacuum tubes, and while using a Lenard tube he noticed a fluorescent effect on a small cardboard screen painted with barium platinocyanide when the current was turned on despite a covering of plain cardboard between the vacuum tube and the painted cardboard. It occurred to him that some invisible ray must have passed through the plain cardboard and caused the fluorescence. He then turned to a Crook's tube which has a much thicker glass wall and confirmed his suspicions that a new type of penetrating ray was being generated by electrical current passing through the Crook's tube. He temporarily labeled them "x-rays" using the mathematical "x" for something unknown. Nearly two weeks after his discovery he took the very first known human x-ray, a picture of his wife's hand.

It showed the soft tissue as a soft gray outline and the bones and metal finger ring in sharp contrast and detail. Incidentally, some scientists recently attempted to duplicate that procedure and determined that the original exposure was about 20 minutes compared to a fraction of a second for a modern x-ray, and the radiation dose was 10 times greater than the modern system. Roentgen's original paper "A New Kind of X-rays" was published December 28, 1895 (he published a total of three papers on x-rays between 1895-1897). On January 5, 1896, an Austrian newspaper reported Roentgen's discovery of a new type of radiation. The news spread rapidly around the world and the demand for Crook's tubes was overwhelming.

Since the danger of overexposure was not yet known, there were no governmental regulations of x-rays at the time and would not be for many years to come. Thus, anyone who had the money could buy a tube and use it in any way that they pleased. Many x-ray machines were made for frivolous, foolish, and even potentially dangerous reasons. For example, early in the century a department store advertised a "family portrait", promoting a group x-ray of an entire family. Most of these toys died out soon, but some persisted for quite a while.

Marginally more serious applications included its use in shoe stores, which offered fluoroscopic images of customer's feet inside the shoes to check for good fitting lasting until the 1950's and 1960's. Some industrial uses were worthwhile, as construction companies x-rayed weldings to check for unseen cracks, and airplane manufactures and inspectors used x-rays to look for early metal fatigue in aircraft. Government agencies have used x-ray screening of baggage and airfreight for years and more recently for human screening in air flight security.

The most logical and beneficial use of x-rays is the medical application. Physicians all over acquired x-ray machines for use in their practices. The first known clinical application in the United States was an x-ray image of a fractured arm at Dartmouth College on February 3, 1896. During 1896 approximately 1000 articles about x-rays appeared in United States scientific publications, and physicians began acquiring x-ray rigs with generators, transformers, glass vacuum tubes, and photographic plates. The most popular reasons for x-rays initially were "bullets, bones, and kidney stones".

The first biologic effects of x-rays were noted in 1896 when people working with repeated x-ray exposures experienced skin changes, some later determined to be cancerous. Conversely, they also observed changes which led them to believe that controlled x-ray exposure of patients could cure skin cancers and other dermal lesions.
Some physicians abandoned their own use of x-rays because of the time involved in making and developing x-ray plates and the health hazards. Some of them persisted in x-ray uses, developed cancers and died. Others used lead shields to protect themselves and their helpers and lived a normal life span. Dr. Roentgen always used lead shielding in his work.

In 1913 William D. Coolidge, a physicist at General Electric Company, developed a hot Coolidge tube with a shielded container. He started a significant change in medical x-rays as the Coolidge tube steadily replaced the unshielded vacuum tube. At about the same time most x-ray users converted from using emulsion coated glass plates to using flexible cellulose film which was much easier and simpler to use. This film rapidly replaced glass plates and became almost the sole imaging medium until the advent of digital imaging in the 1990's.

Following Roentgen's announcement of his discovery of x-rays there was a widespread practice of referring to his rays as "Roentgen rays" and the medical use of them as "Roentgenology". While Roentgen preferred the name "x-ray", the terminology persisted, and even today the designation of "Diagnostic Roentgenology" is still used medically. Nonetheless, "Radiology" has largely replaced "Roentgenology" as the description of the imaging and therapeutic specialty as it became apparent there were other types of radiation besides x-rays.

Various combinations of alpha and beta charged particle emissions and gamma ray electromagnetic wave emission take place during decay processes of radionuclides as they convert to more stable nuclides. Gamma ray emissions from radionuclide states of elements such as Technetium, Iodine, Xenon, or Indium bear similarities to x-rays formed from x-ray tubes, and are detected by Nuclear Medicine Gamma Cameras as part of the imaging process for such exams as bone, lung, HIDA (Hepatobiliary Imino Diacetic Acid) or white blood cell imaging.

Very soon after Roentgen's announcement of the discovery of x-ray, a need to measure x-ray exposure, both in diagnostic and therapeutic uses, became obvious. The measurement unit initially used and (to some extent still referred to today) is named in honor of the discoverer Roentgen (r). In 1928, a Roentgen was defined as:
Roentgen = A unit of exposure to medium energy x-radiation being the quantity of x-rays or gamma

rays that will produce 2.08 by 109 ion pairs/cc air at standard conditions of temperature and pressure.

This was obviously a mathematical physical description and soon other designations came into use:
Radiation Absorbed Dose (RAD)
Roentgen Equivalent MAN (REM).

Although not mathematically, physically, or biologically accurate, for practical purposes one can assume that a (r) is similar to a (RAD) or a (REM). Since the (r) is a relatively large designation of radiation the more useful designation is milli rad (mRAD) or milli Roentgen (mr).

Basically, a Roentgen is a measure of exposure, and rads and rems are measures of absorbed dose.

Biological Effects of Radiation:

It was initially thought that "small doses of radiation stimulate tissue and large doses kill". However, it was soon proven that the apparent "stimulation" effect was really the early attempts of tissue cells to repair x-ray induced damage. Nevertheless, the practice of giving small "stimulant doses to hypo-functioning endocrine organs such as pituitary, thyroid, pancreas, adrenal glands, and ovaries of women having difficulty conceiving was attempted by many radiologists. Most of these efforts were soon abandoned. However, small dose ovarian radiation procedures persisted until the late 1950's and early 1960's in some centers (including Lancaster) – since occasionally a woman would subsequently become pregnant (no doubt in spite of not because of the radiation).

Background Radiation

We are exposed to radiation from natural sources all the time. The average person in the U.S. receives an effective dose of 3 mRem per year from naturally occurring radioactive materials and cosmic radiation from outer space. These natural "background" doses vary throughout the country.

Radiation Therapy:

It became obvious soon after the biological effects of radiation were discovered that those cells in the process of dividing were much more susceptible to harmful effects than those cells at rest. This became the basis for radiation treatment of cancer – since cancer cells are reproducing much more rapidly than the normal cells surrounding them. Thus the rationale of exposing cancer cells to enough radiation to kill them, but not enough to kill the surrounding normal cells.

Major radiologic organizations:

1900 – The American Roentgen Ray Society (ARRS) was the first major radiologic organization in United States. It was formed by doctors who practiced radiology exclusively or devoted the majority of their practice time to radiology.

1915 – Radiologic Society of North America (RSNA)

1916 – American Radium Society (ARS)

1923 – American College of Radiology (ACR)

1925 – American Medical Association (AMA) accepted a section on Radiology

1933 – American Board of Radiology, Incorporated (ABR)

American Roentgen Ray Society:

The ARRS was the first radiologic society in America and as stated previously was originally for physicians who limited their practice exclusively or primarily to radiology. Over the years the eligibility for membership has been widened and more strictly defined. Active members consist of practitioners of Radiology, Radiology Oncology, and Nuclear Medicine in North America, including US territories. Medical school graduates who have completed a radiology residency program are eligible for associate membership.

The ARRS publishes monthly the American Journal of Roentgenology (AJR). The society has an annual meeting, usually in varying United States cities although it has had some meetings in Canadian cities. At the meeting there are scientific and technical exhibits with representatives of major radiologic supply companies demonstrating their latest products. There are daily refresher courses that all qualify for continuing medical education (CME) required for maintaining medical licensure or specialty accreditations by various government and specialty organizations. The ARRS also offers self assessment modules (SAMS) online and in its monthly journal to fulfill requirements by the ABR to keep certificates valid.

The ARRS membership is 20,000+.

Radiological Society of North America:

The Radiological Society of North America (RSNA) was founded in 1915 by physicians primarily limiting their practice to radiology. It was a rival organization to the ARRS although most radiologists belonged to both societies. Membership requirements varied throughout the years. At the present, active members are Board Certified radiologists, radiation oncologists, radiation physicists, nuclear medicine physicians, and radiological scientists. It also has other categories of membership of allied medical and radiologic personnel. RSNA grew steadily until it became the largest radiologic society in the world. Its publishes the monthly journals “Radiology” and “RNSA News”, as well as the bimonthly journal “Radiographics”. RSNA holds an annual meeting in Chicago in November and this has grown to be the largest radiologic meeting in the world. For years it was held at the Palmer House in Chicago, but by the early 1960’s it had outgrown that hotel, and is now based in Chicago’s McCormick Convention Center. Just as the ARRS, there are scientific and technical exhibits, vendors of all sorts of radiology products, data refresher courses, daily scientific sessions, and much more.

The RSNA membership is 40,000+

The American College of Radiology (ACR):

The ACR was founded in 1923 by a number of leading radiologists. Initially the only requirement for membership was that the physicians restrict their practice entirely or nearly entirely to radiology. The eligibility has been modified over the years and now is:
Graduate of recognized medical school.
License to practice in at least one state.
Completion of approved radiologic residency.
Certified by the American Board of Radiology.

The ACR publishes a monthly bulletin. It also sponsors an annual convention.

State radiologic societies are member chapters of the ACR.

The ACR has an honorary designation of a Fellowship (FACR). The radiologist can only be nominated by two active Fellows of the college, at least one of which is not in practice with the nominee. The requirements for nomination are:

1. Active membership of the ACR for at least 10 years.
2. The member has made significant contributions to radiology in research, publishing of scientific articles, teaching, continued active service and participation in medical or other radiologic organizations.

As a result, the largest numbers of FACR radiologists overwhelmingly are present in large medical centers. There are about 34,000 members of the ACR and there are only about 3,400 FACR's. There are three known Fellows in Lancaster County, Dr. Andrew Koch, Dr. Keith Haidet, and Dr. Robert Basarab. All three radiologists are or were with LRA (Lancaster Radiology Associates) at LGH.

American Board of Radiology (ABR):

In his 1932 presidential address to the ACR, Arthur Christie, Washington, DC radiologist, voiced his opinion that a new specialty Board should be created to provide examinations for certification as specialists in the discipline of radiology. It would be called the American Board of Radiology (ABR). After two years of discussion, in March of 1934 representatives of the ACR, ARRS, ARS, RSNA, and the AMA section on Radiology met in Washington DC and incorporated the ABR (it was the fifth medical specialty Board to be created). In June of 1934 the first examinations were given. The exams were entirely oral and for many years the format remained the same. The exams were given twice a year with an average of 1000 examinees in each session. At first there were only 5 Categories:
General Radiology
Diagnostic Roentgenology
Roentgenology
Radium Therapy
Therapeutic Radiology

Today the Categories include:
Diagnostic Radiology,

Radiation Oncology
Subspecialties:
Nuclear Radiology
Neuroradiology
Pediatric Radiology and Vascular and Interventional Radiology were added from 1984 through 2008.

The requirements for eligibility to take the examination varied throughout the years; at present these consist of:

1. Completion of a Residency training program at an approved institution. This is a four year residency; a fifth year of general medical training was desirable but optional.

2. License to practice medicine in at least one state.

The format of the examination has changed since its inception in 1934. It now consists of a written and an oral exam. The written is to be taken several months before the oral and must be passed to be eligible to take the oral. As the quality of Residency programs improved the passing rate rose rapidly from the initial 60% to approximately 93% in the past several years.

As of 2010, there were 65,000 Board Certified radiologists.

As far as can be determined, all of the practicing radiologists in Lancaster County in the past six decades have been Board Certified.

Most Lancaster County Radiologists belong to all of the major societies. This is necessary to keep up with new developments and also to satisfy mandatory continuing medical education (CME) requirements and also recertification policies that are being required. Constant perusal of articles in the radiologic literature and attendance at scientific lectures and refresher courses at the annual conventions of the master societies is vital.

Local radiologists have been active in medical and radiologic organizations. Dr. Hugh Hoke served a term as President of the Lancaster General Medical Staff. Dr. Terence Moore served as term as President of the Pennsylvania Radiological Society. Dr. Andrew Koch was secretary of the Eastern Radiologic Society for a number of years and then served a term of President for one year.

II RADIOLOGY IN LANCASTER COUNTY

GENERAL DISCUSSION:

Since there were no government regulations over x-rays or radiology until the 1950's and 1960's, it is not known by whom or when the first x-ray equipment was brought to Lancaster County.

Dr. Henry Davis arrived in 1923 and was the first radiologist at LGH and head of the department until his death in 1946. Dr. Wilhelmina Scott joined him in the 1930's; they were soon married, and she took over the department in 1946 until her retirement in 1963.

Dr. Paul W. Eyler arrived in the late 1940's, and became head of the department in 1963, serving until 1970.

ST. JOSEPH HOSPITAL – LANCASTER REGIONAL MEDICAL CENTER

At about the same time that Dr. Davis came to LGH, Dr. Robert Swab became the first head of the department at St. Joseph's Hospital (now Lancaster Regional Medical Center). He also had a private office on East Orange Street. He died in 1960. Those that followed include:

Dr. Armond Kabakjian came to Lancaster after World War II, was part-time at St. Joseph's, and also had a private office on East Orange Street. He died in 1970.

Dr. Paul Snoke established a private office on College Avenue in the late 1930's and practiced into the 1960's. In addition to radiology he administered radium in his practice and served as a radiologist for the Columbia Hospital for many years.

Dr. Roy Deck was at St. Joseph Hospital from 1955 until 1975 when he left to open a private office on Butler Ave from 1975 to 1980. He was associated with the Osteopathic Hospital from 1975 to 1984. He was also the radiologist for the State Hospital for Crippled Children from 1955 to 1970.

Dr. Robert Jacobs was chairman of the Radiology department at St. Joseph's Hospital from the early 1960's to 1975. His associates were Dr. Hack Kim who came around 1970 and Dr. Jules Yavil. They all left in 1975 after a disagreement with hospital administration. Dr. Kim entered the practice of internal medicine. Dr. Jacobs moved to Texas, and the whereabouts of Dr. Yavil is unknown.

Dr. Robert Bernhard was recruited to be the new chairman and his partners were Dr. Parry Miller, Dr. Richard Weismer, and Dr. Paul Collura. They formed a group – St. Joseph's Radiology Associates (SJRA). In addition to the radiology department at St. Joseph's they opened an outpatient imaging center named Harrisburg Avenue Radiology Associates (HARA). HARA was a full service outpatient center except for MRI and nuclear medicine. It operated in the medical office building across the parking lot from Lombardo's Restaurant until Lancaster Outpatient Imaging (LOI) was formed in 1998. When LOI was formed the center moved to the old Rohrerstown Diagnostic Imaging facility. LOI was a joint venture between St. Joseph Hospital and SJRA. LOI operated under the name of Imaging Center of Lancaster (ICL). ICL installed MRI shortly after the move, thus providing full radiology services except for nuclear medicine. ICL recently opened a second facility at Lancaster Breast Imaging.

Dr. Bernhard continued as chairman of SJH until 1989. For several years the chairmanship changed frequently, with Dr. Weismer, Dr. Miller, and Dr. Jess Parker each serving short terms.

Dr. Robert Springer has been chairman since 2002.

SJRA renamed the group Lancaster Radiology Imaging Associates (LRIA) in 2000 when HMA bought out St. Joseph's Hospital and renamed it Lancaster Regional Medical Center. The group began covering Heart of Lancaster Medical Center in 2005. Dr. Weismer was the first chairman at 'Heart'

followed by Dr. Alexander in 2007-08, Dr. Peter Smith in 2009, and Dr. Kartic Shah 2010 to present.

Soon after acquiring St. Joseph Hospital, Lancaster Regional Medical Center established a radiation treatment center in the medical building across from the hospital. It is named Keystone Cancer Center. The director is Dr. Glenn Mieszkalski. Dr. Wallace Longton also practices part-time (he also works at the cancer center in Carlisle).

OSTEOPATHIC HOSPITAL

The Osteopathic Hospital moved to its long-time location at the east end of Lancaster on Orange Street in 1941. As far as can be determined, Dr. Kegerise had an office across the street from the hospital and was also director of the x-ray department in the hospital.

William Betts, D.O. became full-time director of Radiology at Osteopathic in 1960 and continued until his death in 1990. John Pulich, D.O. joined him in 1975 and became head of the department in 1990, when Dr. Betts died. He was joined by associates Anthony Skiptunas, D.O., Susan Schetler, D.O., Tom Schaffer, D.O., and Stan Laucks, M.D. Dr. Skiptunas succeeded Dr. Pulich as chairman of the department. In 1998 Health Management Associates (HMA) acquired the Osteopathic Hospital and re-named it Heart of Lancaster Regional Medical Center and made plans to build a new facility in Lititz. Drs. Skiptunas and Schetler left around 2002, before the move to Lititz was complete. Fox Chase Radiology was awarded the contract at the new hospital and the chair was Dr. Ernie Camponova.

EPHRATA COMMUNITY HOSPITAL

The original hospital was located on Main Street at the Ephrata Mountain Springs Hotel (now Hampton Inn & Suites and Applebee's Restaurant). It is not known what, if any, radiologic services were available or who may have directed such service.

The current hospital was opened in November, 1949. Dr. Luke Youndt was the initial radiologist, joined several years later by Dr. James Wilwerth. The list of subsequent active radiologists is as follows in the approximate order they joined:
Active*
Samuel D'Amato, M.D.
Donald Cameron, M.D
Robert Mulligan, M.D.
*Robert Brosbe, M.D.
Allison Lee, D.O.
*Carole Wirth, M.D.
Kenneth Neigut, M.D.
*John Nawa, M.D.
John Oh, M.D.
*Anthony Giordano, M.D.
Michael Sachenik, M.D.

Debbie Durisek, M.D.
George Crawford, M.D.
Joffre Lewis, M.D.
M. Dane Wallisch, M.D.
*Huyen Cao, M.D.
*Ellen O'Mara, D.O.
*Peter Stillwell, M.D.
*Richard Weismer, M.D.
*Paul Collura, M.D.

Allan Springer, M.D. and Robert Springer, M.D. were contracted for interventional procedures.

Dr. Youndt served as chief in 1977 when he was succeeded by Dr. Wilwerth. Subsequent chiefs have been Dr. D'Amato, Dr. Werth, Dr. Durisek, and Dr. Nawa, who is the current imaging chairman.

The radiologists are incorporated as Ephrata Radiologic Association (ERA) and independently contracted with the hospital.

Other imaging modalities added were as follows:
Ultrasound – about 1982
CT – about 1984
MRI – about 1992
The change from film to digital was begun in August of 2006 and completed with the change from mammo to digital by January 2010.

Additional facilities were added as follows:
Adamstown location – Cocalico Diagnostic Services
Brownstown location – Crossroads Medical Imaging
Lititz location – Cornerstone Imaging
New Holland location – Garden Spot Imaging
Leola Location – Meadowbrook Imaging

PRIVATE RADIOLOGY PRACTICES – Dr. Marguerita Schultz.

Dr. Marguerita Schultz is the last of the independent solo practicing radiologists in Lancaster County. She opened her office in 1980 at 1300 Millersville Pike in the same office building that her husband, Dr. Robert Schultz had an internal medicine practice. She provided the following x-rays services: diagnostic radiology, mammography, chest, abdomen, extremities, gastrointestinal studies, barium enemas, gall bladder, intravenous pyelograms, tomograms and arthrograms.

She did a study on Amish women in Lancaster County for a human geneticist from the University of Michigan. This involved a nurse recruiting the Amish women on whom she did mammograms. She then sent the films and interpretations to the University of Michigan along with blood tests made on the same patients. The geneticist was looking for a gene responsible for breast cancer and any

correlation between breast density and carcinoma. Dr. Schultz did approximately 3000 of these exams between the years of 2006 and 2009.

Dr. Schultz's practice peaked in volume around 1990. Her referrals gradually decreased as more and more of her referring doctors and practice groups made mutually beneficial agreements with local hospitals. Unfortunately these agreements required that practicing physicians direct all their referrals of laboratory and x-ray exams to the specific hospital.

Dr. Schultz retired in 2009.

III LANCASTER GENERAL HOSPITAL RADIOLOGY

LGH in general:

There is a continuity present at LGH that does not exist in the other two Lancaster Hospitals (St. Joe became Lancaster Regional Medical Center, and Osteopathic became Community Hospital, then Heart of Lancaster Medical Center, at which time it moved to Lititz). Consequently the historical developments at LGH, founded in 1893, are better known than any of the other institutions. Hence radiology at LGH will be discussed in some detail. The reader can assume similar events occurred at the other facilities at the same time or soon thereafter.

The radiology department was originally located on the first floor just over the outpatient and emergency unit in the old Lime Street building. In the 1940's, after World War II and until the 1960's, most x-ray facilities had the following basic x-ray machines:
X-ray tables that could be used for films of the torso, pelvis, extremities, and joints,
A chest unit – for upright and PA and lateral films of the chest with a 6 foot tube to film distance. X-ray machines designed specifically for head, neck, sinus, and dental examinations. Fluoroscopic tables with an x-ray tube beneath the tabletop was capable of fluoroscopy and spot films. They would usually be tilted 90 degrees to upright and 30-45 degrees Trendelenburg (LGH had 4). At least one table with tomogram capabilities had the ability to obtain a sliced image of a body part. This involved the film carriage in the table and the x-ray tube above the table to move simultaneously, in synchronized fashion and in opposite directions during the x-ray exposure. The level of the slice that is in focus is determined by the height of the tube above the table established with a predetermined scale. These exams had numerous applications, the most common being for evaluation of the mediastinum and/or nodules in the chest, details of various joints, especially knees, shoulders, hips; also kidneys during the IV urogram. Portable units are used for patients unable to come to the x-ray department or for use in the OR.

At the same time, although megavoltage up to 1 million volts were used in some university medical centers, the basic unit in all other therapy departments was the 250 KV machine, except for skin cancers and superficial lesions where a 125 KV unit was used.

Until the early 1960's all fluoroscopy had to be done in complete darkness. To be able to see the fluoroscopic screen the radiologist had to dark adapt his or her vision either sitting in complete darkness for 15-20 minutes or more often by wearing red adaptive goggles for 15-20 minutes. Then in the early 1960's the technical advance of image intensification was developed and the fluoroscopic

image was intensified (brightened) 1000 times and fluoroscopy could be performed in ordinary roomlight conditions.

THE RADIOLOGISTS' RELATIONS WITH THE HOSPITAL:

From the beginning radiologists were either employees of the hospital where they practiced, or had some sort of contractual arrangement in which their compensation was related to the volume of the practice. In the 1960's there were strong efforts made by organized radiology to get all hospital-based radiologists to gain a more independent status. This took the form of separate billing for their professional services. Newly Board Certified radiologists were counseled to accept positions only where such independence was present. As a result, it became nearly impossible for a hospital or a group to add new members if such independence was not in existence or assured. To remain competitive in recruitment of qualified radiologists, the LGH radiologists negotiated an agreement with LGH administration and Board of Trustees that the contract was not with each individual radiologist, but with a professional corporation consisting of the active radiologists then practicing at LGH. So in November 1971 Lancaster Radiology Associates, Ltd. (LRA) was incorporated with Drs Andrew Koch, Emmet Cooper, Duane Goldman, William Young, Roger Peterson and John Ebersole as charter members. The terms of the agreement between LGH and LRA were relatively simple. The hospital would continue to provide space, equipment, personnel and maintenance of the radiology department, and LRA would continue to manage the department and provide radiologic services to the medical staff 24/7. The hospital would, in turn, continue as the billing and collection agency for radiologic services, and the only change that anyone would see would be that the bill now showed an amount for technical services (space, equipment and technical personnel provided by LGH) and professional fee (for supervision and interpretation by radiologists). The total fee remained the same as before. The transition was smooth; hardly anyone noticed.

LRA decided that for obvious reasons it would be advantageous for the President of LRA and the Chairman of the Radiology Department to be the same person. Elections would be held annually.

Dr. Andrew Koch was chosen at the first election and reelected until he retired as Chairman of the Department in 1986. The Chairmen of the Department since then have been:

Dr. William Young	1986 – 1991
Dr. Hugh Hoke	1991 – 1993
Dr. P. Noel Connaughton	1993 – 1996
Dr. Robert Latshaw	1997 – 2000
Dr. Leigh Shuman	2000 – 2005
Dr. Robert Latshaw	2005 – present

Lancaster Radiology Associates, Ltd - Physicians

Retired:
Lottie Varano, M.D
Terrence Moore, M.D.
Andrew W. Koch, M.D.

William W. Young, M.D.
Roger S. Peterson, M.D.
Emmet Cooper, M.D.
Duane Goldman, M.D.
John Ebersole, M.D.
Hugh H. Hoke, M.D.
John W. Gareis, M.D.
P. Noel Connaughton, M.D.
Robert Basarab, M.D.

Current (2012):
Kenneth G. Berkenstock, M.D.
John Briguglio, M.D.
Thomas A. Brooks, D.O.
Colleen Buffington, D.O.
Gene A Carpenter, M.D.
Angela Choe, M.D.
Jeffrey S. Eshleman, M.D.
Edgar C. Fearnow III, M.D.
Alex Feinstein, M.D.
John H. Garofola, M.D.
Robert E. Gress, M.D.
Keith R. Haidet, M.D.
Cindy Janesky, M.D.
Jennifer L. Kegel, M.D.
Pamela Koch, M.D.
Jeffrey P. Kramer, M.D.
Robert F. Latshaw, M.D.
David P. Lawrence, M.D.
Benjamin Y. Lee, M.D.
Paul A. Leslie, M.D.
Dhiren Y. Patel, M.D.
Rebecca G. Pennell, M.D.
M. Clive Perry, M.D.
Paul R. Sherban, M.D.
Leigh S. Shuman, M.D.
Kishor Singapuri, M.D.
Gene C. Smigocki, M.D.
Nitin K. Tanna, M.D.
Simon Westacott, MB, BS
Patrick N. Weybright, M.D.
Matthew C. Wiggins, M.D.

Radiologists were considered associates after joining LRA, and became shareholder members in the Corporation in 1-2 years, unless there was mutual agreement to work under an alternative employee arrangement.

TURF ISSUES IN RADIOLOGY

As utilization of x-ray increased there were inevitable turf issues. As physicians exclusively trained in interpretation of and oversight responsibility for medical imaging with ionizing radiation, and usually without any specific office practice separate from a hospital, Radiologists felt they were the most qualified and capable, and, therefore, should be the only professionals using the modality especially for any sophisticated procedures. However, over the years many other physicians felt they had a need for imaging apparatus in their practice, for example:

Family practitioners – for chest and extremities
Cardiologists – for heart evaluation
Orthopedic and General Surgeons – for bones, joints, etc.
Obstetric and Gynecology – for evaluation of pregnancies and pelvic organs
Neurologists, Neurosurgeons – for CNS, spine, etc.
Urologists – for kidneys, bladder and urethral studies

The situation at LGH was typical. In many cases there was at least initial cooperation on special studies.

Example: Neurologists and neurosurgeons injected air into the spinal canal, and then under the control of either x-ray technicians or radiologists did ventriculograms in the OR and pneuomoencephalograms in the radiology department.

Likewise, myelograms were done in the radiology department with the neurosurgeon or neurologist injecting contrast material into the spinal canal and the radiologist making appropriate films while fluoroscoping the patient. At first, nonabsorbable oil based Pantopaque contrast material was used, and then removed by the neurosurgeon or neurologist under fluoroscopic control by the radiologist. Later, absorbable water soluble contrast material was used for the myelograms.

The first cerebral arteriograms were made with the neurologist or neurosurgeon administering contrast material by direct percutaneous injection into the carotid artery and saying “shoot” as the injection was ending: The technologist would then make the films for the arterial phase of the cerebral circulation, change cassettes as quickly as possible, and make a second film to capture the venous phase. In the mid 1960’s rapid cassette chargers were developed and many more films caught the entire circulation. This was followed soon by ‘cine,’ which gave dynamic imaging of the cerebral circulation.

The urologists would inject contrast material into the ureters and kidneys for retrograde pyelograms in the operating room or the radiology department under fluoroscopic control by radiologists or x-ray technicians.

Gynecologists would inject contrast into the uterus and fallopian tubes for hysterosalpingograms under fluoroscopic control by radiologists who made spot films during the procedure.

The first cardiac catheterization was performed at LGH in the early 1970's in the radiology department. The cardiologist performed the right heart catheterization (Sones Technique), the radiologist the left heart catheterization and coronary angiography (Judkins technique).

CHANGES IN RADIOLOGY DEPARTMENT

In December of 1970 major changes occurred in the LGH radiology department. There was a move to the ground floor of the "new" building where it is still located. The size of the department doubled. This included the first dedicated interventional room. Also a radiation center opened under the director of Dr. John Ebersole who became the first full-time radiotherapist. Until then, the direction of radiotherapy had been done by members of the radiology department who were Board Certified in General Radiology. The first cobalt machine was installed. Also in 1970, Willow Lakes Family Health Center opened with general radiology services offered. Other significant changes were as follows:

1972 First linear accelerator acquired for radiation therapy
1973 Ultrasound started in the radiology department
1977 CT Scanning
1978 First gamma ray camera for bone scan in nuclear medicine division
1980 Crooked Oak facility including x-rays services opened
1981 Second linear accelerator added replacing the Cobalt unit
1985 MRI opens
1987 Rohrerstown Diagnostic Imaging (RDI) - joint venture between LRA and LGH
1989 Willow Lakes opens with general radiology services offered.
1989 Gamma knife added to therapy division
1994 Health Campus (now Suburban Outpatient Pavilion) opens full service radiology facility. Nearby RDI was closed to avoid duplication of nearby services.
1994 Radiation therapy department was moved to the Cancer Center in the Health Campus
1995 LGH purchased Columbia Hospital and renamed it the Susquehanna Division. Radiology services offered.
2000 Women and Babies Hospital opened with appropriate radiology services
2003 (March) Kissel Hill opened with general radiology services offered
2003 (July) Columbia opened as LGH ambulatory center
2005 Norlanco opened as part of LGH with radiologic services
2005 (July) Breast Center opened
2006 CT simulator was added
2008 Downtown Outpatient Pavilion opened with radiologic services
2009 (June) Tomotherapy added to Cancer Center.

RADIOLOGIC TECHNOLOGY PROGRAM:

The Radiologic Technology School was started in 1961 with a class of 3 students by Dr. Andrew Koch, who initially taught all of the courses.

The program was accredited by the JRCERT within 5 years of its beginning and has continuously retained its JRCERT accreditation.

Originally the program director was the chief technologist and in approximately 1975 a full-time program director was appointed. The program has graduated over 200 students since its inception. Almost all of them have passed the registry examination on their first attempt.

RADIATION THERAPY:

The Radiation therapy division was moved to the Campus center in 1994. There are now 3 radiation therapists: Dr. Kishor Singapuri, Dr. Jeffrey Eshleman (director), and Dr. Kenneth Berkenstock. There are 12 radiologic technologists. There are approximately 16,000 treatments administered per year.

The equipment currently being used:
Two Varian linear accelerators with IMRT capability
Tomo therapy
16-slice CT stimulator
Leksell gamma knife
Siemen stabilipan
Nucleatron HDR unit
Low dose brachytherapy

INTERVENTIONAL RADIOGRAPHY:

Dr. Duane Goldman joined the radiology department staff at LGH in the mid 1960's. He was the first interventional radiologic specialist. This included angiography, both arterial and venous, arthrograms and lymphangiograms.

Some of these procedures have been partially, or in some cases totally replaced by newer imaging modalities. For example, lymphangiograms have been made obsolete by new ultrasound, nuclear medicine, and CT techniques. MRI has largely replaced arthrograms. Ultrasound is often preferred to contrast injected arteriograms and venograms.

On the other hand, with the use of catheters being introduced through the antecubital and iliac arteries specific vascular studies can be performed of pulmonary arteries, renal arteries, superior and inferior mesenteric arteries, and pelvic arteries.

Lumbar puncture is another interventional procedure done by radiologists when requested. Tissue biopsy, abscess drainage, tumor cryoablation, percutaneous nephrostomy, embolization procedures on tumors and for trauma patients with active bleeding, and therapeutic catheter placement are some examples of other commonly performed interventional services.

MAMMOGRAPHY:

In 1960 x-ray examination of the breast (mammography) was developed by Dr. Robert Egan of the M.D. Anderson Cancer Center in Houston. The first mammograms at LGH were made in the early 1960's, using regular x-ray equipment adapted for breast examination. For many years mammograms were performed only on patients who had breast symptoms (a lump, pain, bleeding or nipple eversion or inversion). The number of examinations gradually increased from several a week to several a day by 1969.

In 1970 the department moved to a new location on the ground floor of the "new building" and the first dedicated mammography x-ray unit was installed. Also in the early 1970's the first needle localizations for biopsy of a suspicious area were initiated. Small gauge straight needles were used, with the tip placed by approximation without a localization grid close to the suspicious area. Repeat imaging to check needle location commonly necessitated needle repositioning. The needle was taped in place and the patient sent to the operating room. The surgeon made an incisional biopsy and the biopsy specimen sent back to the radiology department to be x-rayed, suspicious area confirmed, and exact location designated for attention by the pathologist. Very soon special localizing needles were developed through which a fine wire hook could be passed and anchored in place at the desired location.

The two most commonly used needles were named after the radiologists who devised them, Homer and Kopans. These were placed with the guidance of a localization grid, making needle repositioning a rarity.

At first during the 1960's and 1970's breast x-ray films had not yet been specifically adapted to meet the unique requirements for imaging soft tissue anatomy in fine detail, but improved rapidly from 1971 to 1980 with xero mammography (xero radiographs). This gave an image of the breast as blue lines on the white paper. This was somewhat better for detecting the very fine microcalcifications that often were a sign of early breast cancer. For several years the examinations were done only on symptomatic patients but by 1970's breast screening was rapidly gaining acceptance at the urging of radiologic societies, the American Cancer Society, OB and GYN organizations and the AMA. The volume of mammograms increased dramatically by the late 1970's and there was full a schedule every day. At present there are 150 to 200 mammograms performed every day.

In addition to being chairman of the radiology department, Dr. Koch also directed mammography until 1980 when Dr. John Garofola accepted section chief responsibilities. By then special x-ray film for mammography had greatly improved in quality so in 1981 xero mammography was dropped and film screen mammograms were again utilized.

In 1982 stereotactic needle aspirations (biopsies of nonpalpable, but suspicious areas noted on mammograms) were initiated by the mammography section of the radiology department. For appropriate cases this was much less traumatic and much less costly than the open biopsies traditionally performed surgically in the operating room. In late 1983 and early 1984 ultrasound guided biopsies were performed. In 2006 biopsies under MRI were introduced.

Imaging was changed to digital starting in 2008 and completed by 2009.

Mammographic imaging is offered at the following locations:
LGH
Campus Health Center
Columbia (Susquehanna Division)
Willow Lakes
Norlanco
Kissel Hill

The Chiefs of the sections since John Garofola have been:
Dr. Julie Mack 2003 – 2006
Dr. Jennifer Kegel 2006 – 2007
Dr. Nitin Tanna 2007 – present

NUCLEAR MEDICINE:

Soon after Roentgen's discovery of x-ray a French scientist Henri Becquerel discovered that some minerals including pitch blend contained natural radioactivity. This led to the work of Marie and Pierre Curie in extracting small amounts of polonium and radium from tons of pitch blend.

Radium, a potent alpha emitting radioisotope and its inherent gas radon were accepted by physicians for treatment of cancer. Radon or radium were captured in small glass or metal needles that could then be briefly inserted into cancers of the face, head, throat, female organs or rectum.

The possibility of other isotopes with short half-life, strongly penetrating gamma rays for treatments and less energetic radiation for diagnostic nuclear procedures was vigorously pursued on both sides of the Atlantic. As a result by 1936 scientists at MIT in Boston and the University of CA in Berkley, California had produced 15 different artificial radioisotopes. Among those showing promise were radioactive iodine for the diagnosis and treatment of thyroid disease, and radioactive phosphorous for the treatment of polycythemia vera.

Although an increasing range in numbers of isotopes were available from laboratories operated by the Atomic Energy Commission after World War II, the growth of nuclear medicine was not nearly as rapid as some of the other diagnostic modalities. By the mid 1950's only large medical centers and teaching institutions were doing nuclear medicine procedures. Then in 1962 techniques involving Technetium 99 with a half life of 6 hours led to easier exams of various body systems. Technetium could be tagged to a substance localized in the body system to be studied. Rectilinear scanners were initially used for imaging, but were soon replaced by a large crystal nuclear scanner, the gamma camera, that gave much more detailed images. In the late 1970's the use of radioactive thallium for heart scans gained credibility by radiologists and cardiologists.

Dr. Emmet Cooper directed the first nuclear medicine studies at LGH. Initial studies were made of the thyroid, followed by lung, brain and bone scans. But eventually just about every system and organ in the body was made available for study.

In 1968 the Harrisburg School of Nuclear Medicine Technology was started. In 1972 LGH became affiliated with the program and participated with the first class of students and medical technologists. In 1976 the Harrisburg School of Nuclear Medicine Technology began operating as the South Central Pennsylvania Consortium for Nuclear Medicine medical training.

In 1994 Harrisburg Hospital announced that for financial reasons it could no longer participate in the Consortium. The advisory committee voted to transfer the administration to LGH. A nuclear medicine program now operates under the Lancaster General College of Nursing and Health Sciences (LGCNHS) and is accredited by Middle States Commission on Higher Education.

Dr. Basarab became head of the nuclear medicine technology training program in 1994. There have been about 400 graduates of the program and almost all have passed their registry exam.

The chiefs of nuclear medicine have been:
Dr. Emmet Cooper mid 1960's – 1986
Dr. Robert Basarab 1987 – 2001
Dr. Scott Winner 2002 – 2006 (left for Hershey Medical Center)
Dr. Robert Basarab 2006 – 2008
Dr. Thomas Brooks 2008 – present

ULTRASOUND

In the mid to late 1960's and early 1970's the possibility of ultrasound being useful in medical imaging was explored in a number of teaching institutions. Early ultrasound was used by ophthalmologists, cardiologists, and OB/GYN physicians. Radiology departments perceived this technology to be an essential component of diagnostic imaging responsibility, and have successfully integrated it into the compendium of imaging services, including image guidance for interventional procedures.

In 1973 the first ultrasound examination was performed at LGH under the direction of Dr. William Young. Scans were made of all parts of the body, sometimes complimenting other modalities, i.e. cysts or solid lumps in the thyroid, breast, testes. More important were applications in vascular structures and OB/GYN studies. Ultrasound was very effective in detecting deep vein thrombosis (in lower extremities) that previously required invasive angiograms.

The contribution to OB/GYN imaging was even greater. In addition to evaluating uterus, fallopian tubes, and ovaries in women, ultrasound was very useful in obstetrics. Until the advent of ultrasound many obstetricians used x-rays very extensively during pregnancies. They made the examinations early in pregnancy to establish the age of gestation, as the measurement of the fetal skull gave a much more accurate fetal age than a menstrual history prior to conception. Then in the latter stages of pregnancy most obstetricians ordered a pelvimetry (2-view x-ray study) to evaluate the mother's bony pelvis to be able to anticipate any difficulty in vaginal delivery and also at the same time the fetus was evaluated. Ultrasound for the most part has replaced x-ray for obstetrical imaging purposes. It is now possible to monitor the intrauterine fetus frequently during gestation with no exposure to ionizing radiation. The use of real time ultrasound can detect the embryo's heartbeat before it can be heard with a

stethoscope. The pregnancy can be continuously evaluated for growth, placental location, etc. The sex of the fetus can be determined accurately for the parents who wish to know. In 1982 diagnostic medical sonography program training courses were developed under the guidance of Dr. William Young. There have been over 200 graduates of the program.

Dr. Young retired in 1994 and Dr. Rebecca Pennell was named chief of the ultrasound division and continues to present. Another chief use of ultrasound exams is Doppler evaluation of blood vessels, especially carotids for plaques, and in the lower extremities evaluation of both arteries for atherosclerosis and veins for DVT.

For the past 4-5 years 3D techniques have been developing and show great promise. Ultrasound is utilized in the guidance of an increasing number of invasive procedures in the OR.

There are over 62,000 ultrasound exams performed annually at LGH.

COMPUTERIZED TOMOGRAPHY

Until the early 1970's only tomograms in the horizontal plane were possible. Then a computerized unit was invented that could make tomograms in the vertical plane. At first it was only possible to do axial exams of head, neck and spine. It was termed "computerized axial tomography" and referred to as "CAT" scan using the first letters of the name of the procedure. Rapid advances soon made exams in other than the axial plane and the exam was then CT but the term "CAT" scan persisted and is still often used.

CT was introduced to LGH in 1977. Early exams were limited to Heads and Spines. Images were pulled off of a Polaroid camera and pasted on file folders for patients.

The first spiral (or helical) CT scanner came to LGH in 1992. Prior to this, patients were told to hold their breath for each individual image that was taken of the chest or abdomen. This increased the chance of misregistration as the patient's degree of breath hold could vary from one picture to the next. Spiral scanning allows an entire body part to be scanned in one breath hold. It provides continuous x-ray exposure and uninterrupted table movement through an entire body part.

Dr. John Gareis was in charge of the section when it first began and continued overseeing the area until almost the turn of the century, at which time Dr. Noel Connaughton began to lead the CT Department.

The turn of the century ushered in the first multi-detector CT scanner. This scanner was not only capable of spiral scanning but was able to take as many as 4 images with each pass of the x-ray tube. Scans were completed in seconds and images were available for review almost instantly on the scanner console. This greatly increased throughput and provided a gold standard for evaluation of such things as blunt traumatic injury.

At the beginning of 2002, Dr. Edgar Fearnow took over the role of section chief of CT and continues to hold the role to this day. At this point, the utilization of CT began to increase greatly at LGH. It was not uncommon to perform over 100 studies a day at the hospital. Multi-detector scanners were

increasing in sophistication and slice capability every year. The demand became so great, that CT scanners were being installed at ambulatory facilities operated by Lancaster General throughout the county. CT scanning is now available to patients not only at the downtown hospital location but at the Suburban Outpatient Pavilion in 1994, Columbia Health Center in 1995, and The Women's and Babies Hospital and Kissel Hill Health Center in 2003. A dedicated Emergency Department CT scanner was added to meet the demand for acute care needs in 2003 as well. Expansions across the street from the hospital saw the opening of the Downtown Outpatient Pavilion offering CT scanning as well as at the Willow Lakes Health Center.

MAGNETIC RESONANCE IMAGING

Magnetic Resonance Imaging (MRI) is a non-ionizing medical imaging technique used in radiology to provide detailed images. A 1.5 Tesla MRI machine uses a powerful magnetic field, 25,000 times stronger than the earth's magnetic field, to align the magnetization of hydrogen atoms in the body, and radiofrequency fields to systematically alter the arrangement of this magnetization causing hydrogen nuclei to produce rotating magnetic fields detectable by the scanner; this information is recorded to mathematically construct an image of the scanned area of the body. The MRI provides good contrast between the soft tissues of the body which makes it especially useful in imaging brain, muscle, heart, and cancers. Unlike traditional x-ray or CT, MRI does not use ionizing radiation.

The technique was discovered in 1971 and first used on humans in 1977. Its value was apparent and medical usage increased rapidly.

By the early 1980's the radiology groups at LGH and St. Joseph's Hospital were eager to acquire MRI capabilities. At the time, the Pennsylvania legislature, attempting to slow the cost of medical care through prevention of unnecessary duplication of machines and facilities, had passed legislation requiring hospitals to have a certificate of need (CON) in order to receive Medicare, Medicaid, and other governmental reimbursement for any new procedure or replacement of apparatus, machine, or device costing over $150,000. The state was divided into regions and in each region there was an appointed panel to rule on every request for CON. This panel consisted of representatives of hospitals, local business, local governments, health care providers, and dedicated concerned local citizens. The purpose of the program was worthy, but at best the process only served to slow down the necessary replacement of obsolete or worn out equipment and delayed the acquisition of new and necessary apparatus. However, this CON ruling was directed only to hospitals and physician groups associated with hospitals. It did not apply to any physicians or other groups that were not having any direct relationship to a hospital.

As a result radiologic groups in both St. Joseph's and LGH almost simultaneously devised plans to acquire MRI without the necessity of first getting a CON.

At St. Joseph's Hospital radiologists formed Harrisburg Avenue Radiology Associates (HARA). They arranged for an outpatient imaging center and MRI facility on College Avenue across from the hospital. The MRI itself was installed by Health Imaging Incorporated in mid 1985. It was one of the first ones put up by Health Imaging Incorporated who went on to install at least 42 more MRI's

in the US and overseas, at least in England. The local facility did business as Lancaster Magnetic Imaging Incorporated.

At LGH the Lancaster Radiology Associates formed a new Corporation with some other interested physicians. The name of the new Corporation was Lancaster Diagnostic Imaging (LDI). The first MRI was installed in the building on the corner of Frederick and Lime Street, in operation before the end of 1985. At first it was a separate facility, but in time was physically connected to the hospital with a corridor.

The first MRI studies were exams of the head and spine. In 1987 modification in the machine allowed high field imaging of head and spine as well as musculoskeletal systems such as shoulder and knee exams.

In 1994 the original MRI machine was replaced with the one that had been at RDI. This magnet brought improved magnetic resonance imaging to the hospital, and carotid and intracranial vessels and renal structures were examined with this machine. Periodic additional improvements were made over the next 15 years allowing detection of stroke, and gradient echo images made it possible to better visualize the thoracic and abdominal aorta as well as pelvic arterial system. In 2009 a new and more powerful MRI machine was installed. This system was extremely fast and gradient images make possible cardiac MRI imaging of valves with motion analysis and myocardial viability assessment. This system using new sequence software also makes possible visualization of very subtle brain hemorrhages.

Dr. Noel Connaughton was section chief of MRI from 1985 to 1994. Dr. Paul Leslie has been section chief from 1994 to present. The name of the governing body was changed to MRI Group in 2002.

At present the MRI section has 31 MRI technologists and 7 magnets at different locations. Besides the Lime and Frederick Street building MRI is also at the following locations:

1994 Suburban Outpatient Pavilion (Health Campus)
2003 Kissel Hill
2005 Norlanco
2006 Suburban Outpatient Pavilion (2nd scanner added)
2009 Downtown Outpatient Pavilion
2009 Eden Road

Over 30,000 exams are performed annually.

ROHRERSTOWN DIAGNOSTIC IMAGING (RDI):

In the mid 1980's the concept of an Imaging Center separate from the hospital became popular. It was felt that patients would be most comfortable in an atmosphere away from the hospital and sick patients. LRA investigated this concept with members of the LGH administration. The same Pennsylvania requirement of CON that complicated the acquisition of MRI was a significant impediment that restrained hospitals from developing Imaging Centers. The requirement of CON

did not apply to private radiology groups. Consequently LRA, with the cooperation of LGH, began an investigation into the feasibility of an independent Imaging Center that would be physically and legally separated from the hospital. Dr. John W. Gareis was appointed head of the project to develop an independent Imaging Center. This would be wholly owned by LRA As a result of the search, a lot on Rohrerstown Road was purchased and the entity opened in 1987 and became known as Rohrerstown Diagnostic Imaging. The facility services included plain films, computerized tomography, mammography, ultrasound, and fluoroscopy for upper GI's, barium enemas, and arthrograms. In the basement of the facility was the billing office of Lancaster Radiology Associates. The Imaging Center was an instantaneous success. It became the place to go for a more comfortable, personalized atmosphere for outpatient radiology studies. All the exams were scheduled and the staff prided themselves in maintaining appointment times. A radiologist staffed the Center at all times and was often available to give the patient the results of their exams immediately. It was very common to produce 70 or 80 exams in one day with a mixture of CT's ultrasound, mammograms, plain films, and gastrointestinal exams. Eventually, an MRI unit was purchased and placed on site at this facility. Meanwhile, national trends reflected the growing popularity for outpatient medical services, and the hospital administration decided to develop their own outpatient center, separate from the hospital that would include medical office space, diagnostic imaging, physiotherapy, laboratory facilities and radiation therapy. With the development of this center which was also located on Rohrerstown Road, the Rohrerstown Diagnostic Imaging Center became redundant and was sold to the hospital in 1994. The patient population and diagnostic imaging practice was transferred to the Campus facility. RDI, as this early Imaging Center was known, was indeed a visionary project in our medical community that led to further enhancement of patient care.

DIGITAL RADIOGRAPHY AND PICTURE ARCHIVING AND COMMUNICATION SYSTEM:

Among the significant discoveries or innovations in radiology in the past several decades has undoubtedly been the development of digital radiography (DR) combined with picture archiving and communication systems (PACS). It has revolutionized imaging storage and reporting of x-ray and other imaging modalities. In the days of films in a "routine" exam, the films were developed and an exam request slip was brought to the film file room where it was matched with previous exams made on the patient. These were then taken to the radiology reading room where a radiologist dictated the interpretation. The report was typed by a stenographer and sent back to the radiologist for proofreading and initialing of the report. This report was then sent to the appropriate floor of the hospital or mailed to the referring physician. Of course all "stats" or emergency exams were reported by phone as soon as interpreted. Routinely a "turn-around" time of 24 hours for reports was considered excellent.

In digital radiography the source data x-ray energy strikes a built in detector, is converted to an x-ray image, and the digital data is transferred directly for reading – in fact it can be transmitted wherever it is needed to be reviewed, the ICU or referring doctor's office. Previous exams are also accessible for comparison. This system is called PACS. Interpretations for routine studies generally average availability in 4-8 hours, and any emergency in minutes.

DR and PACS were developed in the 1990's and usage began at LGH with all ultrasound imaging done with PACS by 1999. There were steady additions of imaging systems and satellite sites each year, and by April of 2007 all systems and sites were converted to DR-PACS.

EDUCATION

In 2002 the Lancaster General College of Nursing and Health Sciences was formed. In addition to governing the nursing program, the college took over all other teaching programs in the hospital such as medical technology, surgical technology, and invasive vascular technology. This included the technology teaching programs in the radiologic department – radiologic technology, ultrasound, and nuclear medicine. These all became Associate degree programs with the option of extending training two additional years to be eligible for a Bachelor's degree.

SUMMARY

The radiology department at LGH has progressed from a one man operation starting in 1923 doing several exams a day, to several radiologists and 8-5 routine hours in the 1950's, to now 30+ radiologists enabling on-site 7/24 hour coverage every day of the year. The total exams done at Lancaster General Health for all modalities in 2011 were 394,243:

Mammograms 48315
X-ray 171017
Ultrasound 61272
MRI 30390
Nuclear Med 6777
CT 76472

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