A century of radiology in osteopathic healthcare

ROBERT R. ROSENBAUM, DO, FAOCR

This commemorative note, in recognition of the 100th anniversary of radiology in osteopathic healthcare, reviews the development of the specialty from the initial availability of primitive equipment to its present status as an important component of patient care and a significant element in the consideration of socioeconomic issues affecting patient welfare. The osteopathic medical profession was quick to grasp the potential of the new modality, and its history is an exciting aspect of osteopathic medicine's progress.

(Key words: Radiology, history; radiology in osteopathic medicine; American Osteopathic College of Radiology)

This year is the 100th anniversary of radiology as a component of osteopathic healthcare. Three years after Wilhelm Konrad Roentgen announced his discovery, "x-radiance" equipment was installed at The American School of Osteopathy (ASO) in Kirksville, Missouri.[1] Apparently, this was the second x-ray apparatus installed west of the Mississippi River. The first arteriographic images known to have been made in the United States were accomplished at the American School of Osteopathy following cadaveric injection with a mercury compound that hardened within the vascular system (*Figure 1*). Exposure times were 1 hour or so. The work, authored by William Smith, MD/DO, was published in the December 1898 issue of *The American X-Ray Journal.* (*Figure 2* is the opening page of an article on the procedure, which appeared in the January 1899 issue of *The Journal of Osteopathy.*) Smith and David Littlejohn, MD, who taught "x-radiance and sanitary science" at ASO, compete for the designation of "first osteopathic radiologist."[2]

Other radiographic installations were developed in the Midwest in rapid succession. The Still College Infirmary in Des Moines, Iowa, was performing diagnostic and therapeutic procedures before 1900. Its director of x-ray, A.B. Shaw, published a plea for specialization within the profession in *The Cosmopolitan Osteopath* in 1902. A small amount of radium was in use at the College, and George A. Still, in 1903, speculated that it might be used to treat deep-seated tumors.[3] The Southwestern Osteopathic Sanitarium in Blackwell, Oklahoma, had a department headed by C.G. Tillman, DO, who had been trained in the US Army.

Radiology emerges as an academic pursuit and clinical practice modality

By the early or mid 1920s, the "specialty" of radiology was emerging as an academic pursuit and a clinical practice modality. Earl Hoskins, DO, of the Chicago College of Osteopathy, presented a paper on radiologic research to the American Osteopathic Association (AOA) convention in 1917. He refined the technique of erect postural studies in 1921, emphasizing the effect of leg-length discrepancies on spinal curves. His work, published in the *JAOA* in 1934, was titled "The development of posture and it's importance".[4] The Chicago-based American College of Osteopathic Medicine and Surgery, in 1906, listed a postgraduate course that included "X-Radiance," possibly the first formal postdoctorate radiology training in the profession. The Chicago College of Osteopathic Medicine and Surgery, now the Chicago College of Osteopathic Medicine of Midwestern University, was an outgrowth of that institution.

Important radiologic services were developing on the East and West coasts, following their original appearance in the Midwest. In 1911 or 1912, the Philadelphia College of Osteopathy (PCO), now the Philadelphia College of Osteopathic Medicine, had acquired apparatus, and under Herbert V. Durkee, DO, listed instruction in radiology in its catalog in 1916. The service was substantially upgraded when Edgar O. Holden, DO, Dean of PCO, retained Paul T. Lloyd, DO, a recent graduate, to take charge. Equipment was modernized, investigative work was undertaken, and a training program was developed. Dr Lloyd performed what appears to have been the first intravenous urogram done in the Philadelphia area. He and H. Walter Evans, DO, did a series of 75 uterosalpingograms within a year of the first description of the technique. They reported this series to the 1927 meeting of the AOA.[5] Radiation therapy became an important addition to the PCO department, and the College eventually developed a substantial training program.

Shaw migrated from Des Moines to the faculty of the Pacific College of Osteopathy in 1905 in Los Angeles, which became the College of Osteopathic Physicians and Surgeons in 1914. At Shaw's urging, Dain L. Tasker, DO, eventually limited his practice to radiology, wrote extensively on radiologic subjects, and made exquisite radiographs of flowers for his friends. *The Western Osteopath* published his paper on rib anomalies in 1923.[6] The Los Angeles County Hospi-

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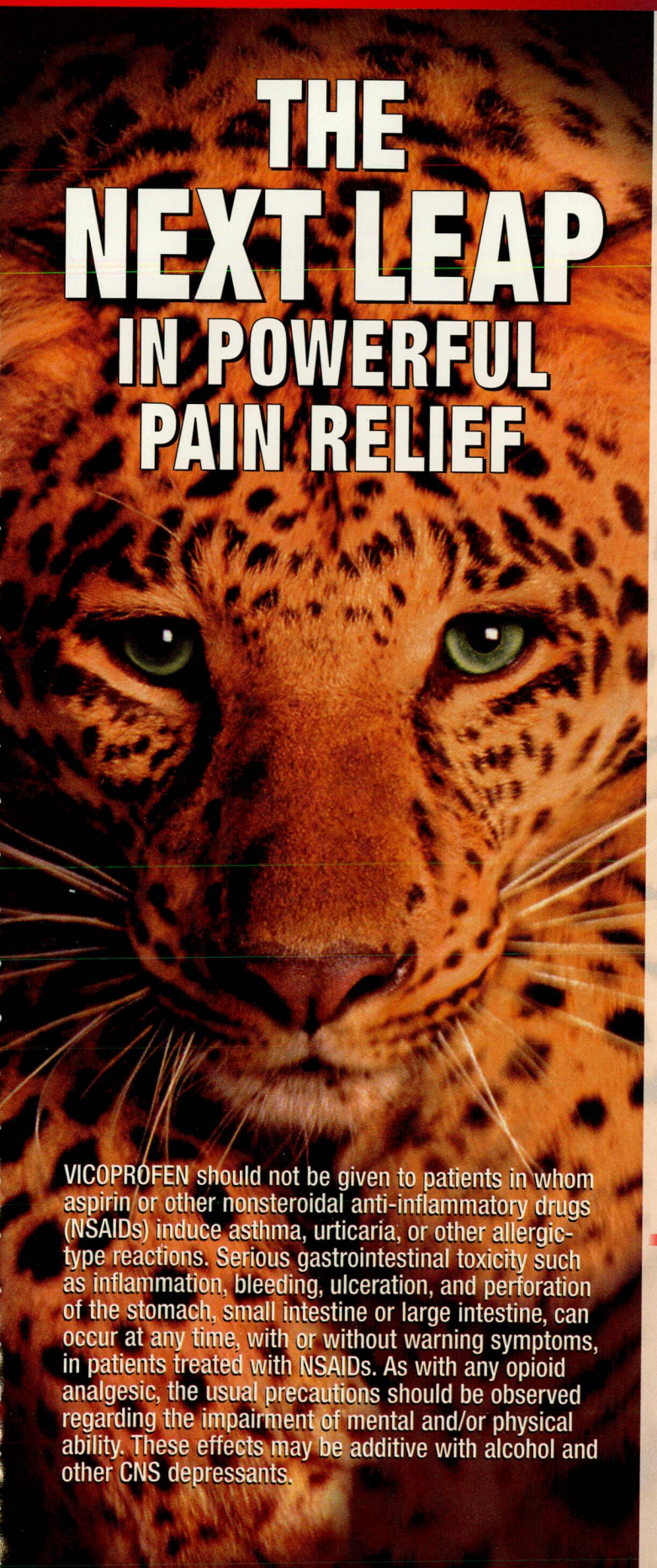
HYDROCODONE AND IBUPROFEN



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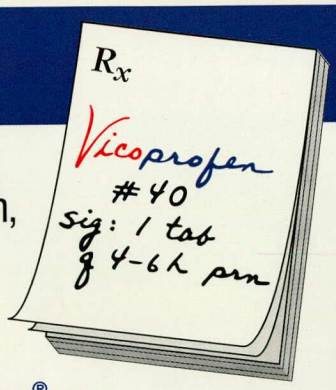

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INDICATIONS AND USAGE VICOPROFEN tablets are indicated for the short-term (generally less than 10 days) management of acute pain. VICOPROFEN is not indicated for the treatment of such conditions as osteoarthritis or rheumatoid arthritis. **CONTRAINDICATIONS** VICOPROFEN should not be administered to patients who previously have exhibited hypersensitivity to hydrocodone or ibuprofen. VICOPROFEN should not be given to patients who have experienced asthma, urticaria, or allergic-type reactions after taking aspirin or other NSAIDs. Severe, rarely fatal, anaphylactic-like reactions to NSAIDs have been reported in such patients (see WARNINGS - Anaphylactoid Reactions, and PRECAUTIONS - Pre-existing Asthma). Patients known to be hypersensitive to other opioids may exhibit cross-sensitivity to hydrocodone. **WARNINGS Abuse and Dependence:** Hydrocodone can produce drug dependence of the morphine type and therefore has the potential for being abused. Psychic and physical dependence as well as tolerance may develop upon repeated administration of this drug and it should be prescribed and administered with the same degree of caution as other narcotic drugs (see DRUG ABUSE AND DEPENDENCE). **Respiratory Depression:** At high doses or in opioid-sensitive patients, hydrocodone may produce dose-related respiratory depression by acting directly on the brain stem respiratory centers. Hydrocodone also affects the center that controls respiratory rhythm, and may produce irregular and periodic breathing. **Head Injury and Increased Intracranial Pressure:** The respiratory depressant effects of opioids and their capacity to elevate cerebrospinal fluid pressure may be markedly exaggerated in the presence of head injury, intracranial lesions or a pre-existing increase in intracranial pressure. Furthermore, opioids produce adverse reactions which may obscure the clinical course of patients with head injuries. **Acute Abdominal Conditions:** The administration of opioids may obscure the diagnosis or clinical course of patients with acute abdominal conditions. **Gastrointestinal (GI) Effects - Risk of GI Ulceration, Bleeding and Perforation:** Serious gastrointestinal toxicity, such as inflammation, bleeding, ulceration, and perforation of the stomach, small intestine or large intestine, can occur at any time, with or without warning symptoms, in patients treated with nonsteroidal anti-inflammatory drugs (NSAIDs). Minor upper GI problems, such as dyspepsia, are common and may also occur at any time during NSAID therapy. Therefore, physicians and patients should remain alert for ulceration and bleeding even in the absence of previous GI tract symptoms. Patients should be informed about the signs and/or symptoms of serious GI toxicity and what steps to take if they occur. The utility of periodic laboratory monitoring has not been demonstrated, nor has it been adequately assessed. Only one in five patients, who develop a serious upper GI adverse event of NSAID therapy, is symptomatic. Even short term therapy is not without risk. NSAIDs should be prescribed with extreme caution in those with a prior history of ulcer disease or gastrointestinal bleeding. Most spontaneous reports of fatal GI events are in elderly or debilitated patients and therefore special care should be taken in treating this population. To minimize the potential risk for an adverse GI event, the lowest effective dose should be used for the shortest possible duration. For high risk patients, alternate therapies that do not involve NSAIDs should be considered. Studies have shown that patients with a prior history of peptic ulcer disease and/or gastrointestinal bleeding and who use NSAIDs, have a greater than 10-fold risk for developing a GI bleed than patients with neither of these risk factors. In addition to a past history of ulcer disease, pharmaco-epidemiological studies have identified several other co-therapies or co-morbid conditions that may increase the risk for GI bleeding such as: treatment with oral corticosteroids, treatment with anticoagulants, longer duration of NSAID therapy, smoking, alcoholism, older age, and poor general health status. **Anaphylactoid Reactions:** Anaphylactoid reactions may occur in patients without known prior exposure to VICOPROFEN. VICOPROFEN should not be given to patients with the aspirin triad. The triad typically occurs in asthmatic patients who experience rhinitis with or without nasal polyps, or who exhibit severe, potentially fatal bronchospasm after taking aspirin or other NSAIDs. Fatal reactions to NSAIDs have been reported in such patients (see CONTRAINDICATIONS and PRECAUTIONS - Pre-existing Asthma). Emergency help should be sought when anaphylactoid reaction occurs. **Advanced Renal Disease:** In cases with advanced kidney disease, treatment with VICOPROFEN is not recommended. If NSAID therapy, however, must be initiated, close monitoring of the patient's kidney function is advisable (see PRECAUTIONS - Renal Effects). **Pregnancy:** As with other NSAID-containing products, VICOPROFEN should be avoided in late pregnancy because it may cause premature closure of the ductus arteriosus. **PRECAUTIONS General Precautions *Special Risk Patients:*** As with any opioid analgesic agent, VICOPROFEN tablets should be used with caution in elderly or debilitated patients, and those with severe impairment of hepatic or renal function, hypothyroidism, Addison's disease, prostatic hypertrophy or urethral stricture. The usual precautions should be observed and the possibility of respiratory depression should be kept in mind. ***Cough Reflex:*** Hydrocodone suppresses the cough reflex; as with opioids, caution should be exercised when VICOPROFEN is used postoperatively and in patients with pulmonary disease. ***Effect on Diagnostic Signs:*** The antipyretic and anti-inflammatory activity of ibuprofen may reduce fever and inflammation, thus diminishing their utility as diagnostic signs in detecting complications of presumed noninfectious, noninflammatory painful conditions. ***Hepatic Effects:*** As with other NSAIDs, ibuprofen has been reported to cause borderline elevations of one or more liver enzymes; this may occur in up to 15% of patients. These abnormalities may progress, may remain essentially unchanged, or may be transient with continued therapy. Notable (3 times the upper limit of normal) elevations of SGPT (ALT) or SGOT (AST) occurred in controlled clinical trials in less than 1% of patients. A patient with symptoms and/or signs suggesting liver dysfunction, or in whom an abnormal liver test has occurred, should be evaluated for evidence of the development of more severe hepatic reactions while on therapy with VICOPROFEN. Severe hepatic reactions, including jaundice and cases of fatal hepatitis, have been reported with ibuprofen as with other NSAIDs. Although such reactions are rare, if abnormal liver tests persist or worsen, if clinical signs and symptoms consistent with liver disease develop, or if systemic manifestations occur (e.g. eosinophilia, rash, etc.), VICOPROFEN should be discontinued. ***Renal Effects:*** Caution should be used when initiating treatment with VICOPROFEN in patients with considerable dehydration. It is advisable to rehydrate patients first and then start therapy with VICOPROFEN. Caution is also recommended in patients with pre-existing kidney disease (see WARNINGS - Advanced Renal Disease). As with other NSAIDs, long-term administration of ibuprofen has resulted in renal papillary necrosis and other renal pathologic changes. Renal toxicity has also been seen in patients in which renal prostaglandins have a compensatory role in the maintenance of renal perfusion. In these patients, administration of a nonsteroidal anti-inflammatory drug may cause a dose-dependent reduction in prostaglandin formation and, secondarily, in renal blood flow, which may precipitate overt renal decompensation. Patients at greatest risk of this reaction are those with impaired renal function, heart failure, liver dysfunction, those taking diuretics and ACE inhibitors, and the elderly. Discontinuation of nonsteroidal anti-inflammatory drug therapy is usually followed by recovery to the pretreatment state. Ibuprofen metabolites are eliminated primarily by the kidneys. The extent to which the metabolites may accumulate in patients with renal failure has not been studied. Patients with significantly impaired renal function should be more closely monitored. ***Hematological Effects:*** Ibuprofen, like other NSAIDs, can inhibit platelet aggregation but the effect is quantitatively less and of shorter duration than that seen with aspirin. Ibuprofen has been shown to prolong bleeding time in normal subjects. Because this prolonged bleeding effect may be exaggerated in patients with underlying hemostatic defects, VICOPROFEN should be used with caution in persons with intrinsic coagulation defects and those on anticoagulant therapy. Anemia is sometimes seen in patients receiving NSAIDs, including ibuprofen. This may be due to fluid retention, GI loss, or an incompletely described effect upon erythropoiesis. ***Fluid Retention and Edema:*** Fluid retention and edema have been reported in association with ibuprofen; therefore, the drug should be used with caution in patients with a history of cardiac decompensation, hypertension or heart failure. ***Pre-existing Asthma:*** Patients with asthma may have aspirin-sensitive asthma. The use of aspirin in patients with aspirin-sensitive asthma has been associated with severe bronchospasm, which may be fatal. Since cross-reactivity between aspirin and other NSAIDs has been reported in such aspirin-sensitive patients, VICOPROFEN should not be administered to patients with this form of aspirin sensitivity and should be used with caution in patients with pre-existing asthma. ***Aseptic Meningitis:*** Aseptic meningitis with fever and coma has been observed on rare occasions in patients on ibuprofen therapy. Although it is probably more likely to occur in patients with systemic lupus erythematosus and related connective tissue diseases, it has been reported in patients who do not have an underlying chronic disease. If signs or symptoms of meningitis develop in a patient on VICOPROFEN, the possibility of its being related to ibuprofen should be considered. **ADVERSE REACTIONS** VICOPROFEN was administered to approximately 300 pain patients in a safety study that employed dosages and a duration of treatment sufficient to encompass the recommended usage. Adverse event rates generally increased with increasing daily dose. The event rates reported below are from approximately 150 patients who were in a group that received one tablet of VICOPROFEN an average of three to four times daily. The overall incidence rates of adverse experiences in the trials were fairly similar for this patient group and those who received the comparison treatment, acetaminophen 600 mg with codeine 60 mg. The following lists adverse events that occurred with an incidence of 1% or greater in clinical trials of VICOPROFEN, without regard to the causal relationship of the events to the drug. To distinguish different rates of occurrence in clinical studies, the adverse events are listed as follows: *name of adverse event* = less than 3%; *adverse events marked with an asterisk** = 3% to 9%; *adverse event rates over* 9% *are in parentheses.* **Body as a Whole:** Abdominal pain*; Asthenia*; Fever; Flu syndrome; Headache (27%); Infection*; Pain. **Cardiovascular:** Palpitations; Vasodilation. **Central Nervous System:** Anxiety*; Confusion; Dizziness (14%); Hypertonia; Insomnia*; Nervousness*; Paresthesia; Somnolence (22%); Thinking abnormalities. **Digestive:** Anorexia; Constipation (22%); Diarrhea*; Dry mouth*; Dyspepsia (12%); Flatulence*; Gastritis; Melena; Mouth ulcers; Nausea (21%); Thirst; Vomiting*. **Metabolic and Nutritional Disorders:** Edema*. **Respiratory:** Dyspnea; Hiccups; Pharyngitis; Rhinitis. **Skin and Appendages:** Pruritus*; Sweating*. **Special Senses:** Tinnitus. **Urogenital:** Urinary frequency. **Incidence less than 1% Body as a Whole:** Allergic reaction. **Cardiovascular:** Arrhythmia; Hypotension; Tachycardia. **Central Nervous System:** Agitation; Abnormal dreams; Decreased libido; Depression; Euphoria; Mood changes; Neuralgia; Slurred speech; Tremor, Vertigo. **Digestive:** Chalky stool; "Clenching teeth"; Dysphagia; Esophageal spasm; Esophagitis; Gastroenteritis; Glossitis; Liver enzyme elevation. **Metabolic and Nutritional:** Weight decrease. **Musculoskeletal:** Arthralgia; Myalgia. **Respiratory:** Asthma; Bronchitis; Hoarseness; Increased cough; Pulmonary congestion; Pneumonia; Shallow breathing; Sinusitis. **Skin and Appendages:** Rash; Urticaria. **Special Senses:** Altered vision; Bad taste; Dry eyes. **Urogenital:** Cystitis; Glycosuria; Impotence; Urinary incontinence; Urinary retention. **DRUG ABUSE AND DEPENDENCE Controlled Substance:** VICOPROFEN Tablets are a Schedule III controlled substance. **Abuse:** Psychic dependence, physical dependence, and tolerance may develop upon repeated administration of opioids; therefore, VICOPROFEN Tablets should be prescribed and administered with the same degree of caution appropriate to use of other oral narcotic medications. **Dependence:** Physical dependence, the condition in which continued administration of the drug is required to prevent the appearance of a withdrawal syndrome, assumes clinically significant proportions only after several weeks of continued opioid use, although a mild degree of physical dependence may develop after a few days of opioid therapy. Tolerance, in which increasingly large doses are required in order to produce the same degree of analgesia, is manifested initially by a shortened duration of analgesic effect, and subsequently by decreases in the intensity of analgesia. The rate of development of tolerance varies among patients. However, psychic dependence is unlikely to develop when VICOPROFEN Tablets are used for a short time for the treatment of acute pain. **OVERDOSAGE** Following an acute overdosage, toxicity may result from hydrocodone and/or ibuprofen. **Signs and Symptoms: *Hydrocodone component:*** Serious overdose with hydrocodone is characterized by respiratory depression (a decrease in respiratory rate and/or tidal volume, Cheyne-Stokes respiration, cyanosis) extreme somnolence progressing to stupor or coma, skeletal muscle flaccidity, cold and clammy skin, and sometimes bradycardia and hypotension. In severe overdosage, apnea, circulatory collapse, cardiac arrest and death may occur. ***Ibuprofen component:*** Symptoms include gastrointestinal irritation with erosion and hemorrhage or perforation, kidney damage, liver damage, heart damage, hemolytic anemia, agranulocytosis, thrombocytopenia, aplastic anemia, and meningitis. Other symptoms may include headache, dizziness, tinnitus, confusion, blurred vision, mental disturbances, skin rash, stomatitis, edema, reduced retinal sensitivity, corneal deposits, and hyperkalemia. **Treatment:** Primary attention should be given to the re-establishment of adequate respiratory exchange through provision of a patent airway and the institution of assisted or controlled ventilation. Naloxone, a narcotic antagonist, can reverse respiratory depression and coma associated with opioid overdose or unusual sensitivity to opioids, including hydrocodone. Therefore, an appropriate dose of naloxone hydrochloride should be administered intravenously with simultaneous efforts at respiratory resuscitation. Since the duration of action of hydrocodone may exceed that of the naloxone, the patient should be kept under continuous surveillance and repeated doses of the antagonist should be administered as needed to maintain adequate respiration. Supportive measures should be employed as indicated. Gastric emptying may be useful in removing unabsorbed drug. In cases where consciousness is impaired it may be inadvisable to perform gastric lavage. If gastric lavage is performed, little drug will likely be recovered if more than an hour has elapsed since ingestion. Ibuprofen is acidic and is excreted in the urine; therefore, it may be beneficial to administer alkali and induce diuresis. In addition to supportive measures the use of oral activated charcoal may help to reduce the absorption and reabsorption of ibuprofen. Dialysis is not likely to be effective for removal of ibuprofen because it is very highly bound to plasma proteins.

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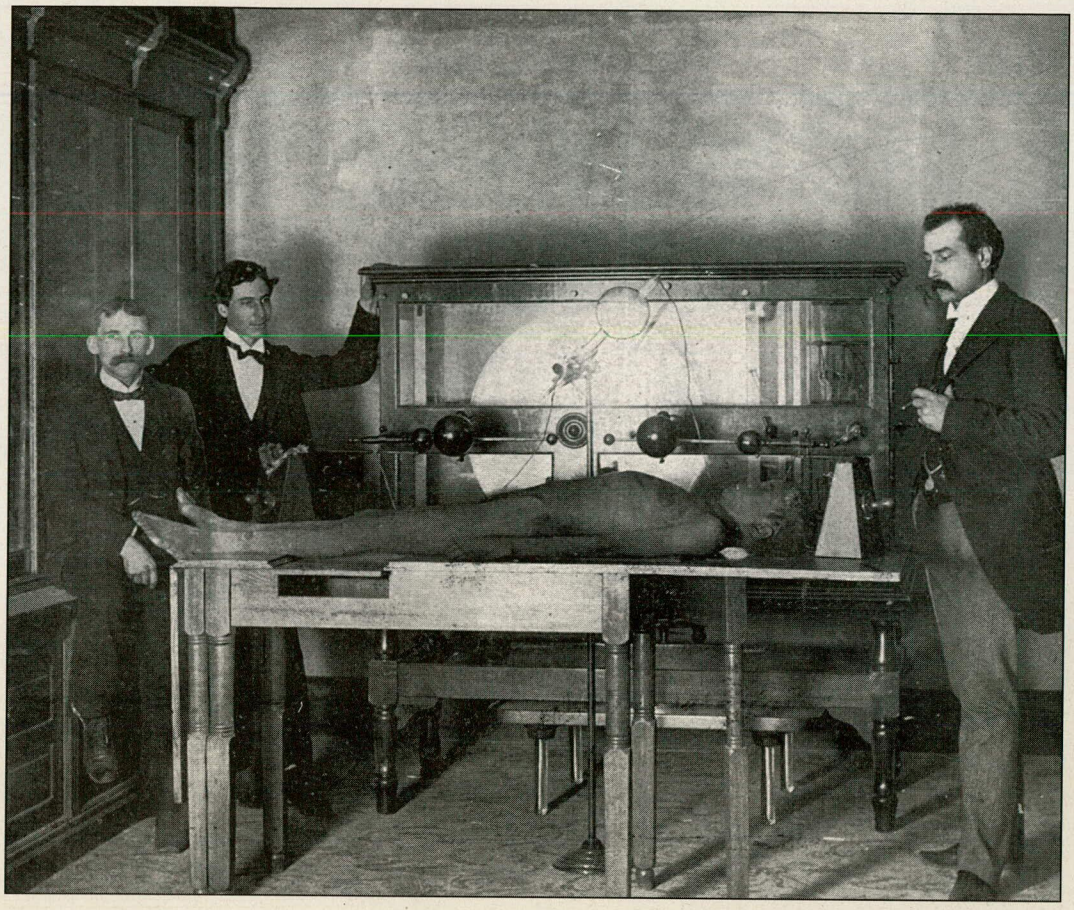

Figure 1. *Arteriographic studies, Kirks ville, 1898. left to right: David Littlejohn, PhD, MD, professor of x-radiance; Lee Hickman, technician; William Smith, MD, DO, research director.* (Courtesy of the Still National Osteopathic Museum, Kirksville, Mo).

tal's Osteopathic Unit opened in 1928 with a three-room radiography suite, headed by Herman E. Beckwith, DO, who also directed instruction at the College of Osteopathic Physicians and Surgeons, which had been called the Pacific College of Osteopathy. The faculty was expanded by 1929, with the addition of Floyd J. Trenery, DO, and Jack Frost, DO. Frost had been trained at the Los Angeles County Hospital.

Trenery had been superintendent and radiologist at the Des Moines General Hospital. His move to California proved to be a seminal event in osteopathic radiology, just as did the addition of Paul T. Lloyd to the PCO faculty. Trenery became chief of the radiology department at Monte Sano Hospital, and after 12 years, entered private practice in Los Angeles. He restricted his practice to radiation therapy, probably being the first osteopathic physician to do so. He and Lloyd were to become compelling forces in the development of radiology as an organized and disciplined component of osteopathic medical practice. Trenery presented a paper titled, "Colloidal gold with radiation therapy in cancer," to the American Osteopathic Society of Radiology, the precursor of the American Osteopathic College of Radiology (AOCR), at the AOA meeting in 1929. The paper was later published in the *Journal of Laboratory Diagnosis*. His contributions to the profession are commemorated by the Trenery Memorial Lecture at the annual AOCR meeting.

Osteopathic radiologists organize

By the early 1930s, it was evident that organization of the radiologists in the profession was necessary for educational and scientific purposes, as well as other mutual interests. In the 1920s and 1930s, an x-ray section met in conjunction with the AOA conventions, and some of the papers presented were published in the *JAOA*. In 1927, the American Osteopathic Society of Radiology was organized with 25 physicians, only 6 or 8 of whom devoted full time to the practice of the specialty. The small membership proved to be insufficient for survival, and although the group held several annual meetings, it disbanded in 1930.

Organizational efforts revived in 1937 in response to the assiduous and tireless efforts of J. Armande Porias, DO, who enlisted the cooperation of many of the osteopathic physicians practicing radiology as a specialty, including Eugene R. Kraus, DO, Paul T. Lloyd, and Floyd Trenery. In 1938, Porias was encouraged by a group of representative osteopathic radiologists to develop a constitution and bylaws for a college of radiology. Criteria for membership eligibility in the organization were difficult to resolve. At the same time, the Advisory Board for Osteopathic Specialists, established by the AOA in 1938, was investigating the certification of specialists. It heard a plea from Floyd Trenery that the AOA appoint a national examining board of radiologists. The AOA Board of Trustees established the American Osteopathic Board of Radiol-

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SKIAGRAPHY AND THE CIRCULATION.

First Delineation of the Arterial System with X-Rays Achieved by the American School of Osteopathy.

WILLIAM SMITH,

Licentiate of the Royal Colleges of Physicians and Surgeons, Edinburgh, and of the Faculty of Physicians and Surgeons, Glasgow. Licentiate in Midwifery, Member of the Medico-Chirurgical Society and Fellow of the Obstetrical Society, Edinburgh. Demonstrator of Anatomy in the American School of Osteopathy, Kirksville, Mo.

THE AMERICAN X-RAY JOURNAL:

IT IS probable that every teacher of anatomy has, at some period or other, felt in his inmost being a desire to see how the structures of the body appeared before being subjected to the mutilation of the knife and the necessary alteration of relations. This desire was satisfied in a great measure so far as the skeletal apparatus was concerned by the advent of the Roentgen rays; but the extreme permeability of the soft parts of the body rendered further observation of little value. In the case of the vascular apparatus an easy method appeared to be the injection of the arteries with some substance impervious to the rays, and, of course, the first agent thought of was mercury. Unfortunately the metal is very heavy and also has a tendency on injection to be erratic in its distribution; as a consequence the mere weight of the injected material breaks down the smaller vessels or in other cases we find serious hiatuses in the resultant radiograph.

The school with which I am connected as Demonstrator of Anatomy recently secured a ten-plate Van Houten & Ten Broeck static machine, together with a Dennis fluorometer and a series of large sized Crookes' tubes, Monell type, and the idea entered my head to try and ascertain whether it was not possible to devise some system of arterial injection which should comply with the following requirements: First, be of such consistence as to be readily injected into the smallest vessels without solution of continuity; second, be almost, if not quite, as impervious to the rays as is bone; third, be of such consistence, either on injection or immediately thereafter, as not to tend to gravitate to the more dependent parts of the body and so leave the higher vessels devoid of injection; fourth, be of such weight as not to rupture the smaller vessels. On these lines I made some experi-

Figure 2. *Opening page of William Smith's article on the use of x-rays which appeared in the January 1899 issue of* The Journal of Osteopathy. (Courtesy of the Still National Osteopathic Museum, Kirksville, Mo).

ogy (AOBR) in 1939—the first specialty examining board in the profession.

The Board conducted examinations according to a rigid protocol. It issued no grandfather certifications. All originally certified radiologists were examined by other examiners. The Board members realized that an educational arm was necessary to preserve practice standards and to serve as a pool for future AOBR members. The question of membership in the organization that had been proposed by Porias, Kraus, and others was now solved. Membership would be limited to certified radiologists. Efforts to establish the AOCR were revitalized. The group convened for the first time in 1941 at the Detroit Osteopathic Hospital. These two events, the formation of the Examining Board and the organization of the College, were fundamental to the subsequent role radiologists were to play in osteopathic healthcare.[7]

AOCR establishes educational standards

The primary function of the AOCR was to be educational. At the time of its inception, opportunities for training were fragmented, often locally organized, and relatively ungoverned by any entity with national status and AOA approval. Over the course of the next quarter of a century, efforts of the AOCR and the AOBR were devoted to establishing rigid and increasingly demanding standards for residency training and for postgraduate study for practicing radiologists. Preceptorships were gradually phased out. Residency programs were initially 3 years and were eventually increased to 4. Midyear and other postgraduate programs sponsored by the AOCR became increasingly sophisticated, intense, and varied in content. The AOCR made many of these efforts in concert with the AOBR, which set standards of training as a requirement for examination and reported areas of deficiency in examinations to the College, guiding the content of educational programs that were sponsored, initiated, and organized by the AOCR.

By the mid 1960s, the AOCR educational activities were spread throughout the year and included a 4-day annual meeting, a midyear postgraduate program, and physics and radiation biology courses for residents. Scientific and technical exhibits became an important element of the annual meeting, aided by the generosity of many commercial exhibitors and donors.

Controversial issues erupt

Convulsive issues affecting radiologists began to develop as the educational activities of the specialty matured. The rapid growth of osteopathic hospitals after World War II and in the 1950s revealed controversial relationships between hospitals and radiology services vis á vis patterns of reimbursement, distribution of income from radiologic procedures, hospital "profit" from radiologic practice, and so forth.[7] Subsequent societal issues and events, from the inception of Medicare to the development of health maintenance organizations, preferred provider organizations, and other models to control the burgeoning cost of healthcare, changed the practice of radiology and the relationship of the radiologist to the referring physician, the patient, and the hospital.

Osteopathic radiologists were lost to the profession when the Los Angeles College became an allopathic medical institution, most California DOs acquired licenses as allopathic physicians, and the California Osteopathic Association merged with the California Medical Association. In the 1970s and 1980s, prestigious allopathic residency training programs encouraged the application and acceptance of DOs, and osteopathic programs suffered losses of applicants. At completion of the training cycle, many osteopathic physicians chose to remain at their training institutions or accepted positions at other allopathic hospitals.

Originally, osteopathic residents in allopathic training programs were denied entrance to osteopathic certifying examinations. A change in AOA policy eventually permitted those who trained under allopathic medical auspices with prior approval of their programs by the AOA Committee on Postdoctoral Training, to qualify for osteopathic certification. This encouraged a return to osteopathic hospitals by some of the trainees. However, many chose to remain, and they have achieved important positions in exemplary institutions. The continuation of training programs in osteopathic medical institutions and success in filling them are ongoing problems. At present, there are 65 residents in osteopathic training programs. Some of these programs are being downsized or eliminated. One hundred six osteopathic physicians are in ACGME-accredited radiology residency programs.[8]

These events were partially engendered by the entrance of radiology into the "hi-tech" era of nuclear medicine, computerized axial tomography, ultrasonography, magnetic resonance imaging, and radiation oncology. Osteopathic radiologists embraced the new modalities, but training was obtainable primarily at institutions with the financial resources to keep current with the technology.

AOCR establishes Education Foundation

At about the same time, the AOCR embarked on a mission of public education in radiologic healthcare issues by establishing the Education Foundation, initially financed by AOCR Board members and other interested contributors, and later by generous help from commercial supporters. In 1987, a videotape for public exhibition and use was produced. Titled "A Gift of Life," it discussed screening mammography in the early diagnosis of breast carcinoma. It was seen by perhaps 20 million television viewers on numerous cable and Public Radio channels and by other groups to whom it was made available on request. The Foundation completed a second project on colorectal cancer, with Steve Allen as a participant. At present, the Foundation directs its efforts toward supporting AOCR educational activities.

Organized radiologists cooperate

The complexities of societal/healthcare and governmental/healthcare issues, as well as the increasing crossover of osteopathic and allopathic radiologic services in both training situations and in hospi-

tal staffing, resulted in gradually expanding cooperation of organized radiology groups and societies. An osteopathic radiologist ascended to the presidency of the prestigious Philadelphia Roentgen-Ray Society. DOs serve on the Mammographic Quality Standards Act Advisory Board, on the American College of Radiology (ACR) Managed Care Committee and on its Task Force on Colorectal Cancer. The AOCR and the American College of Radiology officers and board members attend each others' meetings. The AOCR became a member of the ACR Intersociety Commission, a "think-tank" of delegates from multiple organized radiology groups with various agendas and areas of concern. An osteopathic radiation oncologist is a member of the American Medical Association Relative Value Update Committee. These and other areas of cooperation have afforded opportunity to osteopathic radiologists to help shape, influence, and debate public and governmental policies in healthcare issues.

Osteopathic radiologists train in nuclear medicine

Nuclear medicine became important in clinical radiology in the 1950s. Some osteopathic radiologists were able to attend the basic course offered by the Atomic Energy Commission in Oak Ridge, Tenn, following which they had to be certified in clinical uses of each isotope by attending a required number of clinical procedures under the direction of already-licensed physicians. Osteopathic Hospital Of Philadelphia acquired the first Gamma camera, an early entry into the isotopic medicine instrumentation field, in the profession. A Cliniscanner was installed at Metropolitan Hospital in 1959. Osteopathic radiologists particularly interested in nuclear medicine were already beginning to devote much, or all, of their time to this subspecialty.

In 1971, the AOCR approved the certification examination of the American Board of Nuclear Medicine for its members and petitioned the AOA to establish an osteopathic board for the same purpose. In 1982, the Nuclear Regulatory Commission (NRC), successor to the Atomic Energy Commission, accepted AOBR certification for licensure to use isotopes, and minimal training standards for residents were adjusted to comply with NRC licensing requirements. At present, some osteopathic radiologists restrict their practices to nuclear medicine. There are 88 DOs certified by the AOA and 19DOs certified by the ABR.

Osteopathic radiologists take their place in the military

Thanks to the persistent efforts of the AOA, interestingly recounted by Gevitz,[9] osteopathic physicians are serving in the Armed Forces of the United States in many capacities. A DO radiologist, Richard Lynch, is presently a Brigadier General in the Medical Corps of the US Army Reserve. There are at least four DO radiologists who are members of the Association of Military Osteopathic Physicians and Surgeons, Inc.

Comment

This commemorative history relates the enthusiasm with which the osteopathic medical profession embraced the newly discovered modality of "x-radiance" at the end of the 19th century and early in the 20th ccentury. Osteopathic radiologists made early contributions to the radiology literature, as well as technical and procedural advances. Organized radiology, in concert with the AOA and its committees and commissions, achieved high standards in educational activities and principles of practice. Currently, the cooperation of osteopathic and allopathic radiology groups facilitates the debates, problem solving, and resolution of many problems relating to the changing healthcare environment. It has been an exciting 100 years.

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