

# Sclerotherapy: Clinical Applications in the Treatment of Hernias

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*"The natural conservatism of the physician often causes him to condemn a method of which he has no direct knowledge."*

—LF Watson, MD<sup>1</sup>

Operative treatment of hernia was recorded as early as 4000 BC; however, it did not become popular until the late 19th century after the introduction of antisepsis and general anesthesia, but more important, not until the introduction of high ligation of the hernial sac by Marcy and a slight modification of his method, known as "Bassini's operation." Before Bassini's operation, no technique had been devised to close the inguinal canal without injuring the spermatic cord; therefore, several generations of the so-called Castrati

**In 19th-century Europe, castration was automatically performed during herniorrhaphy because there was no way to close the inguinal canal without injuring the spermatic cord.**

were produced in Italy and other countries.<sup>2</sup>

In 1836 Professor Joseph Pancoast of Jefferson Medical College in Philadelphia became the first prominent American surgeon to treat hernias by injecting tincture of iodine and cantharides into the hernial sac,<sup>3</sup> although another American surgeon, Zophar Jayne, MD, who had patented a syringe with a sharp hollow "beak," may have initiated the procedure in 1832. The syringe he developed was not intended for use as a hypodermic needle, but for injecting fluids into the hernial sac to promote adhesions. Jayne and his colleague, George Heaton, MD, used this technique to treat convicts with hernias in Alton, Illinois.<sup>1,3,4</sup> For a period of 8 years, Heaton perfected his own instruments and the solution of *Quercus alba*, while gaining considerable surgical experience. He proposed that the treatment of hernias should be directed toward injecting connective tissue around the inguinal ring. Heaton used his own blunt

needle to prevent puncture of vital structures. Two small side openings in the needle afforded infiltration of the solution into the surrounding tissue.<sup>3</sup>

In 1843, Heaton published an article entitled "New Treatment of Hernia" in the *Boston Medical & Surgical Journal*. He then invited physicians from Boston and Massachusetts General Hospital to witness a demonstration of the treatment of hernia by injection. However, the invitation was declined. The lay press advocated his treatment and directed public sentiment in his favor. Heaton may actually have cured more patients of reducible hernia with the injection method than had been cured by all other methods combined up to his time.<sup>1,3,5,6</sup>

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Several years later, Heaton visited London, where he was elected a member of the Royal Chirurgical, the Westminster, and the London Societies. He was similarly honored on the continent by induction into the Parisian Medical Society. This recognition partially accounted for the adoption of the injection method throughout Europe, where it was more generally used than in the United States. Heaton's monograph on the cure of hernia appeared 2 years before he died in 1877.<sup>1,3,5,6</sup> Heaton himself was unaware that he had performed hypodermic injections with a needle that was originally designed for subcutaneous injection treatment of hernia. Professor Velpeau, a renowned French surgeon, had been mistakenly credited for the first injection treatment of hernia in 1835. However, Heaton's experience predates this, having begun in 1832

with Jayne.<sup>1,5,6</sup>

Joseph H. Warren, MD, personal physician to and disciple of Heaton, inherited Heaton's writings and instruments (Figure 1) and described them and his own improvements of the method in 1881 in a monograph entitled *Hernia*. Instruments used by both physicians are depicted in detail, and the *Quercus alba* solution was made public.<sup>3</sup> Heaton's work had influenced Professor Bigelow, then Chairman of Surgery at Massachusetts General Hospital, who reported and demonstrated a case of hernia during one of the clinical lectures at the Massachusetts Medical College in 1856 that he, too, had successfully treated with injections. In 1881, Bigelow championed Heaton's method, noting that it may not cure the hernia, but would improve it to such an extent that a truss would offer better control than without

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injection treatment. In the late 1880s, world renowned Professor Theodor Billroth at the University of Vienna noted that "if a solution will be found to cause artificial proliferation of tissue as tough and dense as fascia, then radical treatment of hernia would be solved."<sup>6</sup>

In the late 1880s, injection treatment became very unpopular owing to success of operative treatments and the introduction of hot paraffin injections (designed to work as a plug) into the inguinal canal. This treatment was accompanied by multiple complications. The injection treatment remained in use to repair small hernias and hernias that recur postsurgery.<sup>1,3,5,6</sup>

## INJECTION SOLUTIONS

Ignatz Mayer, MD, a physician in private practice in Detroit began using injection treatments for hernias in 1894. He introduced "Mayer's" solution, the main ingredients of which were zinc sulfate, phenol crystals, glycerine, aqueous cinnamoni, extract of *pinus canadensis* (dark), and sterilized chemically pure redistilled water. Despite the high percentage of cures he achieved in 2000 patients, the local and state medical societies refused to recognize his work. At the end of his

**FIGURE 1** The instruments below belonged to George Heaton, MD and were used by him to treat hernias. After Dr. Heaton's death they were given to Dr. Warren who placed them in the Museum of the Royal Chirurgical Society.<sup>3</sup>



Heaton's syringe with Davenport's needle.



Instrument for injecting the solid extract of Oak Bark.



Syringe for injecting the fluid extract of White Oak Bark.



career, however, Mayer treated the president of the Michigan State Medical Society, who was suffering from a recurrent hernia and who had already had two operations for the problem. When a cure was achieved, Mayer was granted membership in the medical society.<sup>1,3,5,6</sup>

G.A. McDonald, MD, of Fairfield, Illinois published two articles on the injection treatment of hernia and a monograph between 1925 and 1931. He reported a 97% cure rate in more than 10,000 cases using his own patented solution consisting of phenol, alcohol, and Lloyd's specific tincture of thuja.<sup>1,2,5,6</sup> Enrique Pina Mestre, MD, of Barcelona made a significant contribution to the injection treatment of hernia with a solution he called "Hernial." Hernial consisted of an alcoholic extract of herbs that included krameria, catechu, moneci, rosa canina, and vaccinium myrtillicum. He claimed a 98% cure rate in more than 10,000 cases.<sup>1,3,5,6</sup>

Leigh F. Watson, MD, was the author of *Hernia: Anatomy, Etiology, Symptoms, Diagnosis, Differential Diagnosis, Prognosis and the Operative and Injection Treatment*. The first edition was published in 1924. CV Mosby Company published a second edition in 1938. In 1941, the book was entered into the card catalog of the New York University College of Medicine Library. It was recatalogued in 1948, then never opened again—a successful treatment destined to remain ignored.

This article does not purport to acquaint the reader with the contents

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of the almost 600-page volume, but to bring to interested readers the historical aspect of the turbulent course of hernia treatment by injection methods. As it appears from the text and communications with a physician who studied under him, Watson was a master of both methods (injection and operative) and sometimes combined the two. To ensure good healing, he would paint the fascia and the floor of the canal with sclerosing solutions.

Watson emphasized that injecting sclerosing fluids into the abdominal region by a surgeon without adequate experience posed a greater danger than an operation performed by untrained hands. He suggested injecting a weak solution of methylene blue into the internal ring and the canal to verify correct placement of the needle and the solution during an operation. He also pointed out that performing an operation after injection treatment would not pose a problem for a surgeon who was experienced in hernia operations.<sup>1</sup> Although Watson described and operated on all types of hernia, he practiced the injection treatment only on small reducible hernias of the anterior abdominal wall.<sup>1</sup>

Injection therapy in the 1920s and 1930s was used largely to treat varicose veins, hemorrhoids, hydroceles, and hernias. During these 2

decades, a scientific rationale for "obliterative" or "sclerosing" therapy evolved, leading to the establishment of problem-oriented clinics affiliated with prominent university hospitals and medical schools. In 1927, J.S.K. Hall, MD, performed his experiments at Bellevue Hospital in New York on dogs, monkeys, and guinea pigs. He observed an initial swelling and edema, followed by proliferation of endothelial and connective tissue cells. The presence of mononuclear phagocytes, fibroblasts, and giant cells was also noted.<sup>1,3,5,6</sup>

Arthur Bratrud, MD, an Assistant Professor of Surgery at the University of Minnesota, began injection treatment of hernias in 1931. In 1933, he became director of a clinic for the ambulant treatment of hernias at the same institution. He published six articles on the subject and became a recognized authority of this method.<sup>1,5,6</sup> Bratrud experimented on dogs and rabbits, investigating multiple solutions. The following observations were made: (1) After using McDonald's solution, the tissues showed marked induration and early necrosis before fibroblastic proliferation which produced a binding effect on the tissue up to 8 weeks after injections; (2) Slynasol produced marked necrosis with infiltration of polymorphonuclear cells followed by fibroblastic proliferation, resulting in a proliferation of tissues that were spongy in nature; (3) Pina Mestre solution produced a very marked necrosis in experimental animals and was not recommended for use in humans; (4) Eight weeks after injection into the abdominal





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cavity of a dog, Proliferol produced almost complete obliteration of peritoneum with fibroblastic tissue, loops of bowel with adhesions but without obstruction. Overall 15 solutions in various strengths were investigated. The best results were produced by Proliferol and Proliferol-T Special. They were able to conclude that the histologic changes in the tissues of human patients were the same as those observed in injected animals.<sup>1,3,5,6</sup>

Another prominent figure from Minneapolis was Carl Rice, MD, who became director of another injection clinic at Minneapolis General Hospital later in 1933. Rice wrote eight articles and published a textbook on the injection treatment of hernias in 1937. Corroborating with H. Mattson, MD, he reported on histologic tissue changes in humans resulting from injection with proliferating solutions. They obtained specimens during operations 15 hours to 42 days after injections. The earliest changes they observed and were able to demonstrate by histologic slides were polymorphonuclear and round cell infiltration with a few fixed connective tissue cells. On the seventh day young fibroblasts and a few newly formed blood vessels predominated. On the 14th day young fibrous tissue with small

slender nuclei were present. On the 42nd day dense mature fibrous tissue was abundant. Rice described a 97% cure rate in carefully selected cases and a 3% recurrence rate. He also reported complications such as indurations of the spermatic cord, superficial ulcerations of the skin, peritoneal irritations, epididymitis, scrotal edema, hematomas, abscesses, dermatitis, and hydrocele of the cord. There were no mortalities in his series.<sup>1,3,5,6</sup> Similar clinics were also established by W.M. McMillan, MD, Northwestern University in Chicago, and by F.I. Harris, MD, and A.S. White, MD, in San Francisco.<sup>5,6</sup>

Hyman I. Biegeleisen, MD, was an unchallenged inventor of the term “sclerotherapy” in 1936. He used this term for the first time as a name for the injection clinic at the Stuyvesant Polyclinic in New York City. His personal interest in the injection method began in 1930, after the original article by Higgins and Kittel that introduced sodium morrhuate was published in *Lancet*. Biegeleisen performed the first clinical study of sodium morrhuate. It was published in *Surgery, Gynecology and Obstetrics* in 1933. Thereafter he evaluated 5% sodium oleate, the isolated principal fatty acid component of sodium morrhuate. An experimental study was performed on the veins of rabbit ears. Two articles on the subject were published: “Fatty Acid Solutions for the Injection Treatment of Varicose Veins: Evaluation of Four New Solutions,” and “Two Fatty Acid Solutions for the Injection Treatment of Hernia.” Biegeleisen noted that the chief

component of these solutions—fatty soap—was similarly effective. Some of the solutions that were used in these studies were sylvasol, a potassium salt of psyllium seeds; soricin, a derivative of castor oil; and ipotole, a derivative of olive oil. All of the vegetable oil products contained traces of protein and caused allergic reactions. They were eventually taken off the market and replaced with synthetic compounds. In 1937, Biegeleisen introduced ethanalamine oleate, which became used almost exclusively for the treatment of varicose veins.

After the works of Drs. Carl Rice, Penn Riddle, Earl Gedney, and George Hackett were published, Biegeleisen extended his practice to the treatment of hernias and painful low back problems. He became a versatile practitioner of sclerotherapy. Not immune to low back pain himself, he became a good friend and a patient of Earl Gedney. Biegeleisen was the last patient that Gedney treated before he died several days later. In 1960 Biegeleisen and Tuft organized the Phlebology Society of America. He also became a vice president of the International Union of Phlebological and Angiological Societies.<sup>2,7</sup>

At the Parkland Hospital in Dallas, Penn Riddle, MD, an Assistant Professor of Clinical and Operative Surgery, directed the Varicose Vein Clinic at Baylor University, College of Medicine. Riddle wrote a comprehensive textbook in 1940 entitled *Injection Treatment*.<sup>5</sup> Between 1930 and 1940, Riddle emphasized that injection



treatment of hernia with sclerosing solutions received proper and well-deserved attention from academic institutions and leading medical schools. A versatile practitioner of sclerotherapy, he had significant clinical experience in every subject described in this text. He demonstrated a histologic section of the tissue from a patient who received the injection treatment with Sylnasol 32 days before surgery. Histologic specimens were obtained from the fascia, conjoined tendon, external oblique muscle, cremasteric muscle, spermatic cord, and hernial sac. All of the tissue specimens revealed proliferation of the fibrous tissue under microscopic examination. The author had experience with the majority of solutions used at that time. He had reviewed the results of operative methods available by 1940 from different institutions and compared them with the results of his own injection method. The recurrence rate associated with the operative method at Johns Hopkins Hospital, Massachusetts General Hospital, and New York Presbyterian Hospital ranged from 4.1% to 32%, an average of 20%. At Henry Ford Hospital, the recurrence rate was 8.2% and 13% after the first and second operations, respectively. Of 117 patients whom Riddle treated with the injection method, 60% were cured. Some of his patients received up to 40 series of injections over a period of 18 months. Riddle concluded that the injection method should be applied only to the small indirect inguinal hernias in young patients.

Femoral hernias were difficult to fit with a truss. Riddle felt that surgery was the most effective method to handle all types of hernia; however, injection treatment was found to lessen the defect, even when it failed to cure the hernia.<sup>5</sup>

### SUMMARY

As early as 1949, the subject of injection treatment of hernia was excluded from textbooks devoted to sclerotherapy.<sup>8</sup> Recent surgical and medical texts do not offer information on the injection treatment of hernia.<sup>9,10</sup> Today, few practitioners use this treatment for hernia.<sup>10</sup>

Recurrences owing to large defects of the abdominal wall are significantly reduced after the introduction of Marlex and Dacron mesh; however, they remain a problem in 2% to 33% of cases. Addition of injection therapy may reduce these figures.<sup>9-11</sup> The clinical and experimental work performed in the 1930s on the injection treatment of hernia emphasized the histologic changes that induced the healing of connective tissue. This in turn stimulated the interest in the application of this method to the treatment of painful pathology of ligaments and tendons.<sup>12,13</sup>

By the mid-1930s, four major applications of the injection treatment (hernias, varicose veins, internal hemorrhoids, and hydrocele) that would become known as sclerotherapy were established. This eventually led to the application of injection treatment for ligaments and tendons.

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