Legal Aspects of Certain Common Medical Diagnostic Devices

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LEGAL ASPECTS OF CERTAIN COMMON MEDICAL DIAGNOSTIC DEVICES

Howard Newcomb Morse*

OUTLINE

I. THE ELECTROCARDIOGRAM
   A. ADMISSIBILITY IN EVIDENCE OF ELECTROCARDIOGRAM
   B. PHYSICIAN CANNOT TESTIFY AS TO ELECTROCARDIOGRAM WITHOUT PRODUCING IT
   C. ELECTROCARDIOGRAPHIC RECORDINGS AND INTERPRETING
   D. PHYSICIAN WHO TESTIFIES AS TO ELECTROCARDIOGRAM DOES NOT HAVE TO HAVE MADE IT
   E. VALUE OF ELECTROCARDIOGRAM LIES IN PLURALITY FOR PURPOSE OF COMPARISON
   F. CLINICAL CORRELATION

II. THE MYELOGRAM
   A. ATTENDING PHYSICIAN MAY TESTIFY AS TO PATHOLOGY REVEALED BY MYELOGRAM
   B. NO INTRODUCTION IN EVIDENCE OF MYELOGRAM AFTER HEARING OR TRIAL
   C. MAY EMPLOYEE BE COMPELLED TO UNDERGO MYELOGRAM?

III. THE AORTOGRAPH
   A. DANGERS IN AORTOGRAPHY
   B. CAUSE OF PARAPLEGIA FOLLOWING AORTOGRAPH
   C. WHO PERFORMS AORTOGRAPHY
   D. INJURIES FOLLOWING ATTEMPTED AORTOGRAPH
   E. PHYSICIAN'S NEGLIGENT ACTS IN ATTEMPTING AORTOGRAPHY

IV. THE ELECTROENCEPHALOGRAM
   A. ADMISSIBILITY OF ELECTROENCEPHALOGRAMS IN EVIDENCE
   B. RETROACTIVE ADMISSIBILITY
   C. FOUNDATIONS MUST BE LAID
   D. ELECTROENCEPHALOGRAMS AS BASIS FOR EXPERT OPINION
   E. CONFLICTING INTERPRETATIONS OF ELECTROENCEPHALOGRAMS
   F. PROPERTY IN ELECTROENCEPHALOGRAM

I. THE ELECTROCARDIOGRAM

The following brief but excellent definition and history of electrocardiography is contained in Nichols v. Sanborn Co.¹

Electrocardiography relates to the recording in the form of a graph of certain minute electric currents produced by the human heart

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¹ 35 F.Supp. 707 (D. Mass. 1940); aff'd 124 F.2d 654 (1st Cir. 1942).
MEDICAL DIAGNOSTIC DEVICES

in the course of its action. Although the existence of such currents was known as early as the middle of the last century, it was not until 1903 that an instrument able to detect and record them was invented. This instrument is known as the Einthoven quartz string galvanometer, named after its inventor. It consists of a very fine quartz string, gold-plated, which is suspended in a magnetic field. When current passes through the string, the string moves, and by photographing its excursions, a record of its movements may be produced. The electric currents produced by the heart are connected to the string galvanometer by means of electrodes attached to the arms or to one arm and one leg of the patient. When a galvanometer is thus connected to the human body, there is produced, in addition to the heart currents, a constant current of considerably higher amplitude than the currents produced by the action of the heart. This constant current is called the skin current. In order to record the action of the heart without overloading a sensitive instrument such as the Einthoven string galvanometer it is necessary to overcome the effect of the skin current. In practice this is usually done by introducing from some external source into the galvanometer circuit a voltage equal in amount and opposite in polarity to that produced by the skin current. Since skin current varies from time to time and with the individual, this neutralizing voltage must be readjusted from time to time as the instrument is used.

As a result of the invention of the Einthoven string galvanometer, the growth of the modern science of electrocardiography was made possible. This, of course, is a medical science.2

ADMISSIBILITY IN EVIDENCE OF ELECTROCARDIOGRAM

Of the admissibility in evidence of an electrocardiogram, the Supreme Court of Pennsylvania in Myers v. Travelers Ins. Co.3 declared: "[T]here would be no unlawful invasion of plaintiff's rights if competent physicians at a reasonable time and place physically examined him, aided by such mechanical devices as ... electrocardiograph ... . Such matters are within the discretion of the court."4 The United States Court of Appeals for the Third Circuit in Croll v. John Hancock Mutual Life Ins. Co.5 stated: "The doctor's office records as well as the electrocardiogram were properly admitted into evidence under both the Federal Business Records Act, 28 U.S.C. sec. 1732, and the Pennsylvania statute."6

The electrocardiogram was held admissible in evidence by the Supreme Judicial Court of Massachusetts in Kramer v. John Hancock Mut. Life Ins. Co.,7 in 1954. And the Court of Appeals of

2 35 F.Supp. at 708.
4 Id. at 528, 46 A.2d at 226.
5 198 F.2d 562 (3d Cir. 1952).
6 Id. at 565.
New York in *People v. Magri*\(^8\) in 1958 stated: "Almost daily, reproductions by ... electrocardiograms ... among a variety of kindred scientific methods, are freely accepted in our courts for their general reliability, without the necessity of offering expert testimony as to the scientific principles underlying them."\(^9\)

In *Division of Labor Law Enforcement, Dept't. of Indus. Relations v. Gifford*,\(^10\) it was disclosed that it is a hospital practice to include electrocardiographic tracings in a patient's medical record if the patient was confined in the hospital at the time they were taken, even though they are the property of the physician who ordered them.

**Physician Cannot Testify as to Electrocardiogram Without Producing It**

In *Lefebyre v. Western Coal & Mining Co.*,\(^11\) a workmen's compensation case decided by the Supreme Court of Kansas in 1930, the plaintiff contended that the arbitrator was guilty of serious misconduct in permitting a Dr. Major to testify as to what was shown by an electrocardiogram which was taken at a hospital in Kansas City, without producing this electrocardiogram in court for the purpose of cross-examination and submission to the plaintiff's medical experts for their opinion. The court declared:

> It was error for the arbitrator to permit Dr. Major to testify as to what was shown by an electrocardiogram without producing it at the hearing. The doctor stated as his excuse that it was part of the hospital records and could not be taken from the hospital, but that a copy could be obtained. We know of no rule of law that places hospital records in any privileged class. They can certainly be produced in court the same as the records of a corporation or any other records, corporate or private, which may be necessary to do full justice between litigants. The cardiogram should have been produced in court so that plaintiff could have used it for the purpose of cross-examination and for submission to his own medical experts for their examination and to enable them to testify as to their interpretation in the event they disagreed with the doctor who interpreted it on behalf of defendant.\(^12\)

**Electrocardiographic Recordings and Interpreting**

The making of an electrocardiogram is a comparatively simple procedure and may be done by a trained lay technician; however,

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\(^8\) 3 N.Y.2d 562, 147 N.E.2d 728 (1958).
\(^9\) Id. at 566, 147 N.E.2d at 730.
\(^12\) Id. at 9, 289 P. at 460.
interpreting an electrocardiogram is much more difficult and demanding and must be done by a physician, usually a cardiologist or internist. As Joseph E. F. Riseman, M.D., points out,

Electrocardiograms are taken under uniform or standard conditions all over the world. The tracing usually is recorded by a trained technician and does not have to be obtained, or recorded, by the physician personally. The amount of training needed by the technician does not require any unusual amount of previous medical education or knowledge. Interpretation of the electrocardiogram, however, requires a certain amount of knowledge, a considerable amount of experience and a great deal of common sense. This requires medical training and although in many communities the tracings are usually interpreted by specialists (especially those specializing in cardiology or internal medicine) they can also be interpreted by a trained general practitioner.13

It would seem that more weight would be accorded the interpretation of electrocardiographic tracings by a medical witness who is a cardiologist than one who is a general practitioner.

Physician Who Testifies as to Electrocardiogram Does Not Have to Have Made It

In Randolph v. Woman's Club,14 a workmen's compensation case decided by the Supreme Court of New Jersey in 1941, Otto Lowy, M.D., a specialist in pathology and diagnosis, examined the plaintiff twice. The first examination consisted of a complete physical, fluoroscopic, electrocardiographic, and laboratory examination. From this Dr. Lowy discovered that the plaintiff's left auricle was enlarged, that she had a ventricular extra systole, and a tachycardia. The second examination revealed the same thing as the first examination plus a prominent aortic second sound.

The defendant argued that the electrocardiogram was inadmissible as hearsay because it was not prepared by Dr. Lowy. The court characterized this argument as "without foundation." The court observed that the electrocardiogram was made under Dr. Lowy's "direction and supervision and it was he who interpreted the results shown."15

Value of Electrocardiogram Lies in Plurality for Purpose of Comparison

As Dr. Riseman points out: "In order to be of value the elec-

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15 Riseman, Trauma and Angina Pectoris, 4 Trauma, Oct. 1962, at 5, 29 [hereinafter cited as Riseman].

14 127 N.J.L. 49, 21 A.2d 324 (1941).

15 Id. at 52, 21 A.2d at 326.
trocardiogram must be taken at appropriate time intervals. This involves taking tracings early in the disease and repeating the tracing at intervals of a few days to a few weeks in order to study the progressive or serial changes."

If there are two or more electrocardiograms taken at different times which are in existence and obtainable, a court will not permit a medical witness who is giving an electrocardiographic interpretation to be restricted to one electrocardiogram. In *Leibowitz v. Massachusetts Indem. Ins. Co.*, Dr. DeGraff, a cardiologist called as a medical witness by the defendant insurance company, testified that he found nothing abnormal in an electrocardiogram taken by the plaintiff's physician on December 24, 1941. Dr. DeGraff himself examined the plaintiff on behalf of the defendant on January 31, 1942, and took an electrocardiogram.

Dr. DeGraff was then questioned about an electrocardiogram taken by the plaintiff's physician on February 19, 1943. Dr. DeGraff testified that the February, 1943, electrocardiogram showed that something had happened to the plaintiff's heart since he examined it: "There is a suggestion that this man may have suffered some damage to the posterior wall of his heart." Dr. DeGraff then testified that while the February, 1943, electrocardiogram was suggestive he "would like to see another electrocardiogram taken subsequently to confirm this."

Counsel for the plaintiff then attempted to submit to Dr. DeGraff an electrocardiogram taken by the plaintiff's physician on May 26, 1943, after the period of alleged disability for which suit was brought, and to question him about it. The lower court refused to permit this. On appeal, the higher court concluded: "In our opinion, this improper restriction on the cross-examination of Dr. DeGraff... was erroneous and highly prejudicial."

**Clinical Correlation**

An electrocardiogram alone, without thorough clinical correlation, can at best permit only partial diagnosis of the cardiac condition. A medical cyclopedia designed for lawyers states:

The ECG [electrocardiogram] does not furnish a pathologic or clinical diagnosis, but indicates only the state of the myocardium (heart muscle) in electrophysiologic terms at the precise moment of its recording. . . . Proper interpretation and clinical correlation require a com-

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16 Riseman, *supra* note 13, at 44.
plete history and physical examination and other laboratory studies as well. With the information obtained, the physician can distinguish the many disease entities that mimic specific and non-specific ECG patterns. Proper diagnosis must correlate the full history and objective findings for each individual patient with the necessary laboratory studies. Proper correlation requires the total knowledge and experience of the attending physician.\textsuperscript{18}

II. THE MYELOGRAM

A myelogram was defined in 1965 by the Superior Court of Pennsylvania in \textit{Bostic v. Dreher}\textsuperscript{19} as "a diagnostic procedure which involves the injection of an opaque solution into the spinal canal. The patient's torso is then tilted so that the dye may infiltrate the intervertebral disc spaces. X-rays are taken to reveal abnormalities."\textsuperscript{20}

A myelogram, according to the Court of Appeals of Georgia in \textit{Hartford Accident & Indemnity Co. v. Barfield},\textsuperscript{21} is a procedure to help determine the existence of spinal disc lesions... it consists of making a spinal puncture and placing within the spinal canal an iodine containing oil, which casts a shadow on X-ray; tilting the patient and obtaining X-ray pictures with the needle in place, and then withdrawing the oil and removing the needle... some people have headaches and backaches for a week or 10 days following the myelogram [but] many do not... the procedure is not 100\% accurate, but [does] pick up at least 70\% of the disc lesions, including any massive ones... .\textsuperscript{22}

\textbf{ATTENDING PHYSICIAN MAY TESTIFY AS TO PATHOLOGY REVEALED BY MYELOGRAM}

In 1964 in \textit{Hickey v. Chicago Transit Authority},\textsuperscript{23} the Appellate Court of Illinois held that it is proper for an attending physician to testify with respect to the pathology revealed by a myelogram, even though he did not perform the myelogram. However, the myelogram must be produced and put in evidence so as to furnish the basis for cross-examination.

\textbf{NO INTRODUCTION IN EVIDENCE OF MYELOGRAM AFTER HEARING OR TRIAL}

In \textit{Gonzales v. Johnston Foil Mfg. Co.},\textsuperscript{24} approximately one

\textsuperscript{18} 5 LAWYERS' MEDICAL CYCLOPEDIA 80, § 34.14 (1960).
\textsuperscript{20} Id. at 259 n. 1, 213 A.2d at 119 n. 1.
\textsuperscript{22} Id. at 564, 80 S.E.2d at 85.
\textsuperscript{23} 52 Ill. App. 2d 132, 201 N.E.2d 742 (1964).
\textsuperscript{24} 305 S.W.2d 45 (Mo. Ct. App. 1957).
year after the employee filed her notice of appeal from the final award made by the Industrial Commission to the circuit court, she filed in the circuit court a motion to remand, wherein she requested the circuit court to remand her case to the Industrial Commission so that she could place in the record the results of a myelogram made subsequent to Industrial Commission's final award and while the case was pending disposition in the circuit court.

The employee contended that all the liberal and humanitarian elements of the Workmen's Compensation Act demanded that her case be remanded to the Industrial Commission so that she could offer evidence of the results of the myelogram. The circuit court denied her motion to remand, and she appealed this ruling by the circuit court to the St. Louis (Missouri) Court of Appeals.

The appellate court upheld the action of the circuit court. The court of appeals declared:

To permit the employee, or, for that matter, the employer and insurer, to bring in new evidence after a final award has been made by the Commission, would seriously interfere with the finality of the Workmen's Compensation proceedings. If such a course was permitted, claimant could await the Commission's decision and if it was adverse, then search for new evidence in an effort to set aside the Commission's Award. Applying the aforesaid to the facts in this case, the employee, being uncertain of what results a myelogram would show, could postpone the test and rely on the opinions of her medical witnesses that she had a disc lesion and then await the Commission's action on the award. If the Commission's findings and award were adverse to the employee she could then, with nothing to lose, submit to the myelogram test and if the test was favorable to her, she could then ask the Commission to reopen the proceedings for further medical testimony. It is our opinion that having elected to submit her case on the evidence then available, she shouldn't be permitted to alter her trial strategy.25

MAY EMPLOYEE BE COMPelled TO UNDERGO MYELOGRAM?

In Wilson v. Rochester Prods. Div., Gen. Motors Corp.,26 a self-insured employer appealed from an award of the Workmen's Compensation Board granting disability compensation. The employer's sole contention was that the claimant's refusal to submit to a myelogram was unreasonable, and that the claimant should be denied compensation by reason thereof.

The Board had found that the claimant's refusal to undergo the myelogram was reasonable. Most of the medical testimony

25 Id. at 55.
26 282 App. Div. 973, 125 N.Y.S.2d 324 (3d Dep't 1953).
was to the effect that the myelogram is not harmful or injurious, is necessary for proper diagnoses, and that the claimant's refusal was unreasonable. However, there was medical testimony to the contrary, with a qualification as to time. The claimant's physician testified that the claimant should not submit to a myelogram, using such words as "at the present time" and "at this time." The Appellate Division stated:

We think the matter should be remitted to the Board for further development of medical testimony as of a later date. The proposed test is an aid to diagnoses only and in itself furnishes no relief. If the test indicates a herniated intervertebral disc subsequent surgery is necessary for relief, and the reasonableness of such operative procedure should also be developed. Award reversed and the matter remitted to the Workmen's Compensation Board for further proceedings . . . . 27

In the Hartford Acc. & Indem. Co. case the employer, Colonial Stores, Inc., and its insurance carrier appealed from a judgment of the Superior Court affirming the judgment of the Board of Workmen's Compensation denying a petition of the employer that the claimant be ordered to submit to a myelogram and, on her failure to do so, that compensation payments under a previous award cease.

The evidence consisted of the testimony by deposition of a physician employed by the employer, to the effect that it was possible the claimant had a disc lesion, but the witness would not, in view of the claimant's "mental overlay," recommend surgery until he had seen the results of a myelogram. The deputy director (of the Board of Workmen's Compensation) hearing the evidence noted that on a previous hearing in this case on change of condition, three physicians had offered testimony but none had recommended either a myelogram or surgery, and the director found as a matter of fact that the claimant was justified in refusing the myelogram. This finding was affirmed in turn by the Board of Workmen's Compensation and the Superior Court.

A Georgia statute provides: "[I]f the employee refuses to submit himself to or in any way obstructs such examination requested by and provided for by the employer, his right to compensation . . . shall be suspended." Another statute provides: "[T]he refusal of the employee to accept any medical, hospital, surgical or other treatment when ordered by the Industrial Board shall bar said employee from further compensation until such refusal ceases."

Georgia jurisprudence, or case law, has already determined that

27 Id. at 973, 125 N.Y.S.2d at 325.
refusal to submit to surgery will not bar the claimant from benefits under the Workmen’s Compensation Act unless the surgery has been ordered by the Board. And case law has also determined that the Board has jurisdiction to decide whether a refusal of medical services is justified.

Surgery, as defined by Webster’s International Dictionary, is “that branch of medical science concerned with the correction of deformities, repair of injuries, diagnosis and cure of disease, relief of suffering, and prolongation of life by manual and instrumental operations.”

In referring to a myelogram, the Georgia Court of Appeals declared:

An examination of the type here sought, which involves the penetration of living tissue, is much closer to a surgical operation than a simple physical examination, of which the claimant had submitted to many in the past.

... [t]he claimant, upon refusing the myelogram, would not be automatically barred from receiving further compensation, and there was sufficient evidence before the Board—including the fact that the claimant had submitted to all other medical examinations and treatments suggested, that other doctors, at a previous hearing, had not recommended this procedure, that the test was not 100% accurate and was in some cases attended by aftereffects of a painful nature—to support the award finding that the claimant should not be compelled to submit to this procedure.

The judge of the Superior Court did not err in affirming the award of the Board of Workmen’s Compensation.28

It seems unfortunate that one of the elements of evidence which the Georgia court admittedly relied on in arriving at its decision was the fact that the myelogram is not 100% accurate. The electrocardiogram and the electroencephalogram, for example, are both routinely accepted and highly regarded evidentially by courts while they are, like the myelogram, less than 100% accurate.

In the Bostic case the claimant was employed as a laborer. While loading a conveyor, he was struck by a stone and injured his lower back. A myelogram taken by Frederick Goeringer, M.D., the chief orthopedic specialist at Misericordia Hospital in Philadelphia, revealed a small defect at the interspace between L-5 and S-1. The claimant was willing to submit to a laminectomy and Dr. Goeringer wanted to perform that operation.

However, the insurance carrier objected and demanded that the claimant submit to a second myelogram. Its witness was

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Leonard Klinghoffer, M.D., a staff specialist in orthopedic surgery at Graduate Hospital, University of Pennsylvania. "He was of the opinion that claimant 'probably had a herniated disc.'” He attempted to treat the claimant by pelvic traction, but this did not improve the condition. Robert Andrew, M.D., a neurosurgeon, was then called into consultation.

With regard to the first myelogram, Dr. Klinghoffer testified, as follows: "Dr. Andrew wasn't impressed with it too much and he thought he would like to see another myelogram. If this questionable finding was seen again, then it would have significance. On the basis of this alone he didn't think he would want to make a diagnosis of a herniated disc.'”

The claimant's refusal to submit to a second myelogram was based upon his reaction to the first one, which assertedly resulted in the development of phlebitis. The claimant took the position that a ruptured disc may be diagnosed and repaired without the performance of a myelogram, and that its indiscriminate use as a diagnostic technique can lead to serious and harmful side effects. The Pennsylvania Superior Court stated: "[C]laimant's refusal to submit to a second myelogram was not without reasonable cause or excuse.”

III. THE AORTOGRAM

Aortographic technique is described by Vincent J. O’Conor, M.D., as follows:

In 1929, the important diagnostic and investigative method of trans-lumbar aortography was suggested by dos Santos and his associates of Portugal. During this diagnostic procedure, the patient lies upon his abdomen and a needle is inserted through the lumbar muscles on the left side and into the abdominal aorta just below the level of the renal artery. A quick injection of opaque material is made while films are taken rapidly to show the vascular pattern, not only of the aorta and its branches, but of the renal circulation as well. According to Richard N. de Niord, Jr., M.D., [t]he aortogram or injection of the aorta with radiopaque material has now become an accepted standardized procedure routinely done in the diagnosis of obliterative vascular disease. This procedure is usually done for those lesions lying high in the iliac vessels . . . or distal aorta, or indeed can be done in a retrograde

30 Id.
31 Id. at 259, 213 A.2d at 121.
fashion passing a catheter . . . either down through the carotid vessels or up through the femoral vessels to inject dye in the region of the aortic arch . . . for diagnosis of obstructive disease of the arch or vessels of the head and neck.33

DANGERS IN AORTOGRAPHY

The dangers inherent in aortography were listed by Dr. O’Conor as:

(1) pain,
(2) hemorrhage,
(3) thrombosis,
(4) embolism,
(5) renal insufficiency,
(6) neurologic disorders,
(7) allergic reactions, and
(8) other systemic disturbances that may be related more to the general anesthetic in those cases in which it is employed than they are due to the aortography itself;

and listed by Dr. de Niord as:

(1) bleeding through the needle hole in the aorta,
(2) allergic manifestations,
(3) injection into the spinal canal or vertebral arteries causing transverse myelitis with paralysis, and
(4) renal damage.

In Slago v. Leland Stanford Jr. Univ. Bd. of Trustees,34 decided by the District Court of Appeal of California in 1957, the plaintiff-patient suffered paraplegia after an aortogram was made. All the expert medical witnesses who testified at the trial agreed that paralysis is a rare complication of aortography. “This fact [the court declared] does not prove that it normally does not occur in the absence of negligence.”

None of the defendant-physicians’ expert witnesses testified directly that the paraplegia would not occur without negligence. One of the witnesses testified that there are risks attendant upon the aortographic procedure, that vessel occlusion as a result of the drug used in the procedure is one of the risks which must be assumed, and that there is little that can be done to guard against it. A second witness testified that the risks had to be balanced against the importance to the patient of determining the exact

33 5 Lawyers’ Medical Cyclopedia 82, § 34.16 (1960).
diagnosis and the future treatment necessary.

**CAUSE OF PARAPLEGIA FOLLOWING AORTOGRAM**

With the exception of the patient’s expert witness, none of the witnesses could determine the exact cause of the paraplegia. In effect, they stated it might have been one of three:

1. constriction of the blood vessels in the spinal cord,
2. direct damage to the spinal cord, or
3. the patient’s condition, a partially blocked aorta, arteriosclerosis and high blood pressure of several years standing, obliteration of blood vessels and blood supply to the legs, was such that sudden and total paralysis could occur at any moment.

Their testimony was to the effect that the first two conditions could result from aortography.

The patient’s expert witness, from an examination of the roentgenograms showing the needle in place at the times of two injections, offered as his expert opinion that the needle at the time of the second injection was near or in an artery supplying blood to the spinal column. The defendant-physicians disagreed with this diagnosis.

There was no testimony that in aortography, without negligence, a needle could be inserted in a spinal artery. In fact, the testimony was just to the contrary, that there should be no great difficulty in inserting the needle in the aorta. There was a conflict in the testimony, the defendant-physicians’ expert witnesses testifying in effect that the spinal cord could have been affected even if the needle has been properly injected in the aorta and that such a situation might have occurred; the patient’s expert witness testifying in effect that the roentgenograms showed the needle to have been inserted in the wrong place.

**WHO PERFORMS AORTOGRAPHY**

In addition to the attending physician, four expert witnesses for the defendant-physicians testified that it is not a general medical custom in the community for the attending physician to perform or to be present at the performance of aortography, but that it is a general community custom to have the aortographic procedure performed by the hospital personnel who are accustomed to working together in the performance of this and other complicated diagnostic procedures and who perform them regularly. There was no contradiction of this testimony.
The court stated that while the attending physician:

ordered the aortogram (and would be responsible for any negligence in prescribing such procedure) he cannot be held liable for the negligence of the team in the actual performance of it, as he neither participated in, nor had the right to direct it. When a patient is placed in a hospital his attending physician orders many procedures to be undertaken by the hospital staff or employees. Common examples are urinalyses, blood counts, and X-rays. Suppose that in extracting blood for a count the hospital personnel negligently infected the patient. It could not be contended that the attending physician was liable for that negligence. The same is true here. The attending physician cannot be held liable for acts over which he had and could have no control.35

The patient contended that because the majority of the aortograms, in the San Francisco Bay area, were made in two hospitals, 89 at the University of California Hospital, 168 at Franklin Hospital, 68 at all other hospitals (not including Fort Miley Hospital, the figures for which were not available), a total of 325, that it could not be said there is a general custom but merely a custom of those two hospitals. The record was not clear as to how many of this 325 were performed prior to the patient's aortogram. Conservatively at least one-half were. The court held that, assuming only 162 as the proper figure, the performance of that many aortograms "in a given area in a particular way, should be sufficient to establish a custom or practice."

INJURIES FOLLOWING ATTEMPTED AORTOGRAPH

In *Dill v. Miles*,36 the plaintiff-patient, after consultation with the defendant-physician regarding the diagnosis and treatment of thrombophlebitis in the lower portion of the calf of his left leg, was advised to and did enter a hospital, where the physician attempted to make an aortogram. Upon regaining consciousness from the general anesthetic, the patient was informed by the physician that aortography had not been performed, that the aorta had not been located or penetrated, and that nothing had been accomplished in the operating room to aid the physician in examining, diagnosing, or determining the nature and extent of the patient's ailment.

Immediately upon regaining consciousness, the patient began experiencing extreme, excruciating, and nauseous pain, and paralytic sensations in the lower extremities of his body from the first lumbar to his toes, accompanied by a paralysis of his bladder

35 Id. at 571, 317 P.2d at 178.
and inability to void. Although he asked the physician for diagnosis, relief, and treatment of these conditions, the physician did nothing whatsoever. The patient's condition grew progressively worse in the next 72 hours, but the physician still did nothing to diagnose, relieve, or treat such illness, did not advise the patient of the seriousness of his condition, did not advise calling in another physician and surgeon, and finally withdrew from the case.

As a result of such neglect the patient sustained the following injuries: contusions, abrasion, and lacerations of his back in the general vicinity of his first lumbar vertebra, paralysis of both legs, paralysis and loss of control of his bowels, paralysis and loss of control of his bladder, adhesive arachnitis with paraplegia, sexual impotency, extreme arthritis, injuries to his spinal cord in the first lumbar area, permanent damage to his physical and nervous system, and great bodily weakness.

**Physician's Negligent Acts in Attempting Aortography**

The physician held himself out to the patient to be a specialist in translumbar aortography and, as such, attempted to make the aortogram without first performing an allergy test and completing a preoperative reontgenogram. The physician made insertions of an 18-gauge needle (6 inches long) without aspirating it, with accompanying and repeated injections of a chemical dye solution into the patient's spinal cavity, spinal column, bloodstream, and body, this being done in such a manner that the aorta was never located and the blood vessels around the patient's spinal cord were ruptured.

The court declared: "[D]efendant's conscious conduct indicated a reckless disregard and complete indifference and unconcern for the probable consequences of his alleged wrongful acts."37

**IV. THE ELECTROENCEPHALOGRAM**

The electroencephalogram, in the words of O. Spurgeon English, M.D., and Stuart M. Finch, M.D.,

was introduced by Hans Berger and is essentially a means of recording the electrical potentials of the brain by means of various leads attached in the form of small wires to the overlying areas of the skull. The electroencephalogram has proven to be a valuable diagnostic instrument in localizing various intracranial pathological conditions. . . . Often by varying the position of the leads it is possible to locate brain tumors or other intracranial lesions accurately. . . . The electroencephalogram records a pulsating rhythm-

37 Id. at 356, 310 P.2d at 899.
mical type of electrical potential of which both the frequency and voltage are measured.\textsuperscript{38}

The electroencephalogram has been defined by the Court of Appeal of Louisiana in \textit{Betz v. Travelers Ins. Co.}\textsuperscript{39} in 1953 as: "[A] graphic recording of the electrical currents developed in the cortex by brain action and by this examination it can be determined whether [a person] actually suffered any damage to his brain..."	extsuperscript{40}

**Admissibility of Electroencephalograms in Evidence**

In \textit{Mayole v. B. Crystal & Son},\textsuperscript{41} the Appellate Division of the Supreme Court of New York in 1943 held that electroencephalographic tracings and an interpretation thereof by a medical expert were admissible in evidence, the court saying: "The [lower] court committed error in excluding the testimony of plaintiff's medical witness as to the condition or conditions for which the electroencephalogram was a test. It was also error to exclude the electroencephalogram and the records respecting it made in the regular course of business."\textsuperscript{42}

**Retroactive Admissibility**

On appeal in the \textit{Betz} suit for compensation for total disability caused by the explosion of a tank truck on which the employee-plaintiff was working, the Louisiana Court of Appeal reversed the judgment of the lower court and remanded the case to allow the employee to introduce evidence of electroencephalographic tracings made after the conclusion of the trial showing injuries of a permanent disabling nature. The motion to remand had attached to it a letter from Homer D. Kirgis, M.D., a neurosurgeon who testified for the employee-plaintiff by deposition taken on November 19, 1952, in which it was recited that he had an electroencephalogram made of the employee to determine whether the employee suffered a concussion or contusion of the brain. This report was dated May 23, 1953, which was subsequent to the submission and rendition of the judgment in the case. Dr. Kirgis was of the opinion that the employee suffered some injury to his brain and that his mental condition was real rather than feigned. This report showed that the physician, H. Tharp Posey, M.D., who

\textsuperscript{38} O. \textsc{English} \& S. \textsc{Finch}, \textsc{Introduction to Psychiatry} 497 (1964).
\textsuperscript{39} 68 So.2d 666 (La. App. 1953).
\textsuperscript{40} \textit{Id.} at 669.
\textsuperscript{41} 266 App. Div. 1008, 44 N.Y.S.2d 411 (2d Dep't 1943).
\textsuperscript{42} \textit{Id.} at 1008, 44 N.Y.S.2d at 412.
made the electroencephalogram, stated that it was very strongly suggestive of localized brain damage.

The court declared:

If the plaintiff’s disability is real, actual, and not feigned, and he suffers an actual injury to his brain, which would be the basis of his present complaint and which cannot be properly adjudicated at this time because the record does not contain the testimony showing the value of this type of evidence in cases of this kind, we think that the case should be remanded and plaintiff accorded the right to produce it.

... [T]he judgment of the District Court is reversed and this case remanded for the purpose of permitting the plaintiff to take the testimony of Dr. H. Tharp Posey and Dr. Homer D. Kirgis as to the electroencephalogram made of the plaintiff by Dr. H. Tharp Posey for the purpose of showing whether plaintiff suffers any brain damage as a result of his injuries and reserving to defendant the right to produce similar evidence, and after said testimony has been taken, that this case be disposed of according to law.43

FOUNDATIONS MUST BE LAID

In Frey v. State44 decided by the Court of Criminal Appeals of Texas in 1961, a Dr. Crowley testified that electroencephalographic tracings of the robbery defendant’s brain showed that he was normal. Complaint was made of the testimony of Dr. Crowley showing his interpretation of the electroencephalographic tracings of the defendant’s brain by a technician because he was not present during the making of the electroencephalogram, that he relied on the ability of the technician and there was no evidence that the machine was working properly.

Dr. Crowley testified that he was in charge of the electroencephalographic machine, that it was in good working condition, that the electroencephalogram was made by a technician under his supervision, and that he was actually present part of the time while it was being made. “In this,” concluded the court, “no error is shown.”

ELECTROENCEPHALOGRAMS AS BASIS FOR EXPERT OPINION

In Melford v. Gaus & Brown Const. Co.,45 decided by the Appellate Court of Illinois in 1958, Benjamin H. Kesert, M.D., the plaintiff’s expert in neurology, gave his opinion that the injury

44 171 Tex. Cr. 100, 345 S.W.2d 416 (1961).
was permanent. The defendant contended that error was committed in permitting Dr. Kesert to answer a hypothetical question "based on the opinion of another expert." The court held that there was no merit to this contention.

Dr. Kesert expressly stated the basis of his opinion as 1. the evidence of (the plaintiff's) physical condition after his fall, and 2. the testimony of the electroencephalographs showing the progressive abnormality. These, according to the court, were facts in evidence and were properly included in the hypothetical question and were a proper basis of the opinion.

In State v. Carlson,\(^4\) a Dr. Davis testified that electroencephalographic tracings showed an organic abnormality in the arson defendant's brain. Except for this finding, the testimony was in general terms indicating that electroencephalographic tracings like the defendant's were seen in individuals who experienced various diseases or injuries early in life, who had an emotional background of an unstable environment, and in whom the emotional factors produced disturbances of behavior which consisted of irresistible impulses.

No medical opinion was offered based upon the electroencephalographic tracings, the facts as to the defendant's background and early life, the circumstances of the alleged offense, or the defendant's mental capacity or condition at the time of the offense. The court held that the electroencephalographic tracings, practically standing alone without expert medical testimony, were of no probative value.

In State v. Riggle,\(^7\) there being no electroencephalographic instrument in Wyoming, a murder defendant in that state was taken to Salt Lake City to be examined by a Dr. Powell, a neurologist, and have an electroencephalogram taken. The electroencephalographic tracings and an interpretation thereof by a medical expert were admitted in evidence on the issue as to whether the defendant was legally insane, meaning very briefly whether he did not know what he was doing (perception) and, if he did know what he was doing, whether he did not know he was doing something wrong (notion). In this context Henry A. Davidson, M.D., points out:

> Crimes are often associated with violence to the perpetrator as well as to the victim. An electroencephalogram may be helpful with respect to behavior during a concussion-induced fugue. The

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46 5 Wis.2d 595, 93 N.W.2d 354 (1958).
47 76 Wyo. 1, 298 P.2d 349 (1956).
description of the patient's activities should indicate whether he knew what he was doing or whether he really acted automatically; whether he acted as if he felt he were doing something wrong, or whether he acted reflexly.48

CONFLICTING INTERPRETATIONS OF ELECTROENCEPHALOGRAMS

Manfred S. Guttmacher, M.D., and Professor Henry Weihofen state:

Unfortunately psychiatrists still are unable to apply any ... certain tests to solve most of their problems. Even the electroencephalograph requires interpretation of the 'brain wave' patterns which the mechanism records, and interpretations may vary. It is not likely that psychiatrists will, in the near future, be able to attain such certainty in their diagnoses as to bring themselves within the rule that 'where the testimony of a witness is contradicted by incontrovertible physical facts the testimony cannot be accepted.' Until we have a procedure which gives assurance that the expert psychiatric conclusions given in court represent a truly scientific judgment, the courts will hesitate to adopt any hard and fast rule that expert opinion is controlling.49

The following question and answer are from the Cleveland Bar Association seminar on myositis ossificans—orthopedic and neurological witnesses:

Q. Is there any norm that has been established for the interpretation of electroencephalograms? It is a matter of judgment of each electroencephalographer, is that right?
A. Unfortunately, I am afraid you are right. There is a great variation in the interpretation of these tracings.50

PROPERTY IN ELECTROENCEPHALOGRAM

Electroencephalograms, like roentgenograms and electrocardiograms, according to Rowland H. Long, "are the property of the physician who has made them while treating his patient, unless a contrary agreement was made. There is no good reason why the rule should be otherwise. Unexplained, these articles are meaningless to the layman, but they constitute an important part of a physician's records."51

48 H. DAVIDSON, FORENSIC PSYCHIATRY 23 (2d ed. 1965).
50 PERSONAL INJURY ANNUAL 443 (1962).