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MEDICO-LEGAL CONSIDERATIONS OF TRAUMA AND OTHER EXTERNAL INFLUENCES IN RELATIONSHIP TO CANCER

WILLIAM O. RUSSELL* AND R. LEE CLARK, JR.**

INTRODUCTION

Cancer is the term used by physicians and laymen to describe a common malignant disease of man and animal. It occurs in nearly as many different forms as there are types of tissue in the body. Each cancer type usually has its own biological behavior which may vary remarkably in different persons. In the United States, cancer is the second leading cause of death.¹ At the present time, more money is being spent for research, diagnosis and treatment of cancer than for any other single disease. There are sixteen medical journals publishing articles related solely to neoplastic disease and five publications which index and/or abstract cancer articles previously published in medical journals. Despite the amazing amount of information and knowledge that is being accumulated from this remarkable effort, it is not sufficient to allow successful control of more than a few forms of the disease. The student of law and the practicing attorney will find these journals, listed in the footnotes,² invaluable for obtaining scientific

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1. HUEPER, OCCUPATIONAL TUMORS AND ALLIED DISEASES 9 (1942).

2. Medical Journals Publishing Original Articles: *Acta*—Published under the Auspices of the International Union Against Cancer, Louvain, Belgium; *Archiv fuer Geschwulstforschung*—Verlag Theodor Steinkopff/Dresden and Leipzig; *Archivos Cubanos de Cancerologi*—Instituto del Radium, Havana, Cuba; *British Journal of Cancer*—H.K. Lewis and Co., Ltd. London, England; *Bulletin du Cancer*—Masson et Cie, Paris, France; *CA*—American Cancer Society, New York, N.Y.; *Cancer*—J.B. Lippincott Company, Philadelphia, Pennsylvania; *Cancer Bulletin*—Medical Arts Publishing Foundation, Houston, Texas; *Cancer News*—American Cancer Society, New York, N.Y.; *Cancer Research*—American Association for Cancer Research, Inc., University of Chicago Press, Chicago, Illinois; *Index Analyticus Cancerologiae*—Masson et Cie, Paris, France; *Journal of the National Cancer Institute*—Federal Security Agency, Public Health Service National Cancer Institute, Bethesda, Maryland; *Oncologia*—Basel (Schwiz) S. Karger, New York, N.Y.; *Radiologica Cancer*—Masson et Cie, Paris, France; *Revista de Liga Puertorriquena Contra el Cancer*—La Junta Technica, de Gobierno, San Juan, Puerto Rico; *Tumori*—Istituto Nazionale Per Lo Studio E La Cura Dei Tumori, Milano, Italy. Journals Devoted to Indexing and/or Abstracting Cancer Literature: *Wolfe's Lebre von der Krebskrankheit* (1907-1928) Verlag von Gustav Fischer, Jena; *Index to Literature of Experimental Cancer Research* (1900-1935) Donner Foundation Philadelphia, Pennsylvania; *Zeitschrift fur Krebsforschung* (1903 to present) Springer-Verlag/Berlin; *Index to Current Periodical Literature on Neoplastic Disease* (1946 to present), published by the Louisiana State Division of the American Cancer Society; *Cancer Current Literature* (1947 to present) The American Cancer Society, New York, N.Y.

information on cancer. One frequently hears that "if the cause for cancer could be found, the problem would be solved." This is a categorical statement and oversimplifies the problem. There are now many known causes for cancer but no single common factor has been found for all types. If such a common factor is found, it may be nothing more than the inherited capacity for certain somatic cells of the body to undergo malignant transformation. The principal intrinsic factors now known to be important are inherited patterns of proven mendelian form, age, sex and hormonal influences.

This paper is not concerned with intrinsic factors but with the known extrinsic factors that are important in the development or aggravation of cancer. Trauma (extrinsic factor) is frequently claimed by patients with cancer as a contributing influence to the development or aggravation of the disease. It is the purpose of this article to discuss the scientific basis for such claims and review, generally, those known external influences believed to be pertinent to the comprehension and understanding of this problem.

DEFINITION OF TERMS

There is much confusion concerned with the many terms that are used in regard to cancer. If the following terms are completely understood, many misinterpretations in relationship to the facts of a case may be avoided. The reader is referred to standard medical dictionaries³ and textbooks of pathology⁴ for other terms and complete discussions of various types.

1. *Cancer*: Cancer comes from the Latin "cancer" meaning crab. It has been used for hundreds of years in the lay press, as well as in scientific thought and publication as a generic over-all term for the neoplastic process. The term "cancer", therefore, is correctly applied to all malignant tumors including such specific types as sarcoma, carcinoma and the malignant lymphoma group (Hodgkin's disease, lymphosarcoma, etc.), to mention only a few.

2. *Tumor*: Tumor means swelling and comes from the Greek "tumere" meaning to swell. It is correctly used by physicians to describe noncancerous swellings. For example, a man may develop a swelling on his leg, resulting from trauma to the part which causes the soft tissues to swell from hemorrhage. This, obviously, is not a cancerous condition, but an attending physician describing the condition for a hospital record might say, "A hemorrhagic-appearing *tumor*, markedly tender, is seen on the lateral aspect of the right leg." Generally, how-

3. BLAKISTON, NEW GOULD MEDICAL DICTIONARY (1949); DORLAND, AMERICAN ILLUSTRATED MEDICAL DICTIONARY (22d ed. 1951).

4. ANDERSON, PATHOLOGY (1948); MOORE, TEXTBOOK OF PATHOLOGY (2d ed. 1951).

ever, the word "tumor" when used by the medical profession implies a cancerous condition. This should not always be taken for granted. Tumors may be conveniently divided into nonneoplastic (hemorrhagic above) and neoplastic (new tissue growths) conditions. In the former group, the swelling is not caused by the cancerous growth. The neoplastic group may be divided into malignant tumors and benign tumors. Generally, malignant tumors grow more rapidly, metastasize and cause death if not treated. Benign tumors grow slowly, do not metastasize and rarely cause death. Occasionally, scientific qualification of a tumor as benign or malignant is a basis for difference in medical opinion. In the great bulk of tumors, the distinction is clear cut. The distinction should be clearly understood that all cancers are tumors, but all tumors (swellings) are not cancerous.

3. *Malignant*: The laity assumes that a cancerous condition is meant when the term "malignant" or "malignancy" is used to describe a human disease. Moreover, many physicians imply this when they use these terms. For this reason "malignancy" generally refers to a malignant tumor despite the fact that the word is defined as a "tendency to increase in virulence."⁵ "Malignant" is used medically in a variety of ways to express "increasing virulence" such as "malignant hypertension" (high blood pressure), "malignant edema," and other disease conditions.

4. *Neoplastic Process*: The word "neoplasia" means new growth and has been more specifically defined as "an autonomous new growth of tissue"⁶ serving no useful purpose. Because pathologists, in certain instances, have had difficulty in differentiating between a truly neoplastic process and certain reactions of body tissues to injury, as found in some infectious diseases, the term "neoplastic process" has been used for general inclusion of a larger number of disease processes that otherwise might not be called cancerous but have many of the characteristics of cancerous conditions. From a precise scientific standpoint, this is the term that can be used for all types of malignant neoplastic change. It is for this reason that the term will be used freely throughout this article.

5. *Sarcoma*: It has been convenient for purposes of scientific classification to divide the neoplastic conditions into two general groups with qualifying terms for sub-types. The first of these is the so-called sarcoma group and the second is carcinoma. The term "sarcoma" connotes a malignant neoplastic condition in which the cells are derived from a particular type of tissue in the body, bone, bone marrow, blood vessels, fat and all the intervening supporting tissues. A fibrosarcoma

5. WEBSTER'S NEW COLLEGIATE DICTIONARY (2d ed. 1951).

6. EWING, NEOPLASTIC DISEASE 9 (4th ed. 1940).

is a tumor derived from fibroblasts. A liposarcoma is a tumor derived from fat cells.

6. *Carcinoma*: This is a malignant neoplastic condition and represents the second large subdivision from sarcoma. Tumors of this type are always derived from a covering surface of the body or cell of glands. Cancers of the skin are called "squamous carcinoma." The gastrointestinal tract is covered by epithelium and tumors derived from it are called "gastric carcinoma," "carcinoma of the colon," etc. Carcinoma is used for malignant tumors of all parenchymous viscera (lung, liver, kidney, etc.).

7. *Malignant Lymphoma*: This represents a group of malignant conditions truly neoplastic in all senses of the word and a form of cancer.⁷ It is convenient to group this whole class together as "malignant lymphoma" since they are all concerned with the development of the neoplastic process from the lymph or blood forming tissues of the body.

8. *Biopsy*: This term is a combination with the Greek word meaning vision; literally, a vision of life. In medical parlance, it implies the taking of a small piece of tissue from an organ or tumor mass for microscopic examination (5 to 10 microns) by a pathologist. This represents the final and ultimate step that can be taken to establish a diagnosis of cancer. There are many types of biopsy; (1) *excision biopsy* where the whole lesion is removed; (2) *incision biopsy* where only a small part is removed; and (3) *needle biopsy* where a large bore needle is inserted into the diseased area and small pieces of tissue removed.

9. *Metastasis*: The transfer of the cancer cells from one organ to another, not by direct extension of the growth process, but by passage through blood or lymph channels and fluid in the body cavities is called metastasis. A cancer of the colon, for example, that has spread to the liver is said to be metastatic in liver from the primary locus in the colon. A carcinoma of the tail of the pancreas that has grown into the undersurface of the liver because the pancreatic tissue is in contact with the liver is not, strictly speaking, a metastasis, but only direct extension of the growth from one organ to another.

10. *Pathology*: This may be defined as that specialty of medical practice concerned with the causes, processes and results of disease. A qualified pathologist is a doctor of medicine specializing in pathology and holding certification by The American Board of Pathology or having sufficient experience to meet the scientific qualifications of that Board.

7. *E.g.*, Hodgkin's disease (Hodgkin's paraganuloma, Hodgkin's granuloma, Hodgkin's sarcoma); Lymphosarcoma; Reticulum cell sarcoma, etc.; Tumerous conditions accompanying the leukemias.

CRITERIA FOR THE ESTABLISHMENT OF
THE DIAGNOSIS OF CANCER

Claim for damage of any form based upon the relationship of a given situation to a disease must be substantiated by incontrovertible proof of the existence of that disease. In the case of cancer, there is only one way to establish *prima facie* evidence that the patient has cancer and that is through microscopic examination of tissues or body fluid by a qualified pathologist. A clinical diagnosis, even with x-ray evidence, is not sufficient and would not stand scientifically. The presence of cancer is only unequivocally established when a pathologist has seen and identified cells of an abnormal type, believed by him to be characteristic of the neoplastic process. This is best done by excision of the whole tumor (excision biopsy), and if this is not practical, by taking out a small piece of the tissue for examination (incision biopsy). The biopsy, therefore, becomes the cornerstone for establishment of the existence of the disease. This viewpoint was upheld and reiterated in a decision rendered by Judge Russell in a 1952 case, *United States v. Hoxey Cancer Clinic*.⁸ The judge's statement was: "It is equally clear that . . . when the subject of investigation is the existence of cancer . . . the overwhelming preponderance of qualified opinion recognizes that not even the experts can assuredly diagnose this condition without the aid of biopsy and pathological examination."⁹ The most important person in establishing the diagnosis is the qualified pathologist who examines the slide and renders an opinion of the presence or absence of a neoplastic process. It may be categorically stated that if cancerous tissue is removed and given to a pathologist, the correct diagnosis is made in 98% of cases. This degree of correctness is rarely equaled in any other branch of medicine. It necessarily follows that a patient may have a neoplastic process even if the pathologic examination fails to show it because the cancerous cells may not have been present and identified in the particular tissue removed. This is a frequent source of error in evaluating a case for the presence of cancer when one biopsy has been reported negative.

The matter of differing diagnoses when rendered by pathologists on the same slide is frequently of concern to attorneys. This can usually be explained by their usage of different terminologies for the same condition. If the differences in terminology are excluded and general interpretation is reviewed, there is rarely any basic disagreement if the neoplastic process (cancer) is present. The simplest approach would be to ask the pathologist to verify the presence or absence of a malignant neoplastic disease. The greatest sources of confusion arise from certain highly malignant, but poorly differentiated, cancers where, on

8. 198 F.2d 273 (5th Cir. 1952).

9. *Id.* at 280.

interpretation of the same slide, such differing opinions may be rendered as (1) unclassified malignant tumor, (2) unclassified sarcoma or carcinoma, (3) poorly differentiated squamous carcinoma, (4) malignant lymphoma, (5) malignant melanoma, to mention only a few. All of these diagnoses when taken together are in basic agreement that the patient suffers from a cancer of questionable type. Differing diagnoses by pathologists should not be construed to mean that pathologists do not agree as to the precise histologic type of cancer in the great majority of cases since they can usually give a definite histologic type. This is extremely important as will be herein pointed out since, in many instances, the establishment of the precise type may become the important part of the qualification or disqualification of the case.

EXTERNAL INFLUENCES AND TRAUMA IN REGARD TO CANCER GENESIS

It is through our knowledge of the external influences producing the neoplastic process that the greatest advances have been made in the understanding of this disease. The development of this knowledge forms one of the most interesting chapters in the history of medicine. The first scientific observation of external substances producing cancer was reported in 1775 by Sir Percival Pott, a distinguished English physician.¹⁰ He showed that skin cancer developing on the scrotum of chimney sweeps was related to contact with coal dust on the skin. The first scientific confirmation by experiment of the relationship of coal tar to cancer was reported one hundred and forty years later in 1916 by Yamagiwa and Itchikawa, Japanese investigators who painted the ears of rabbits with coal tar and produced cancer.¹¹ From these initial observations and other comparable ones, information has come regarding a large number of compounds now known to produce cancer, either in animals or man by simple contact with body tissue. These substances are called "carcinogens" and the development of the cancer is termed "carcinogenesis." The reader is referred to the publication by Hartwell¹² who reports on 1,329 compounds and substances of known carcinogenic properties. Most of the carcinogenic substances have been developed from hydrocarbons and particularly coal-tar substances. Organic chemical compounds rather than inorganic chemical compounds are the most important. X-ray and other forms of irradiation are known to cause the neoplastic process. X-ray burns in years past were a frequent accident to physicians using x-ray machines in their offices without knowing and utilizing the proper precautionary tech-

10. HUEFER, OCCUPATIONAL TUMORS & ALLIED DISEASES 193 (1942).

11. Yamagiwa and Itchikawa, 15 K. MITT. I. MED. FAK I. KAIS, UNIVERSITAT ZU TOKIO 295 (1916).

12. HARTWELL, SURVEY OF COMPOUNDS WHICH HAVE BEEN TESTED FOR CARCINOGENIC ACTIVITY (2d ed. 1951).

niques. Even today, roentgenologists who take all precautions and get but minimal exposure show an eight times greater incidence⁶ of leukemia (cancerous condition of the blood) than other physicians.¹³ Elimination or control of these external factors and influences, when known, offer immediate solution to the problem. In this category are the so-called "occupational" cancers.

OCCUPATIONAL CANCER

An occupational cancer may be defined as a malignant tumor resulting from some exogenous physical or chemical substance that an employee contacts in his work and must be considered as compensative in the eyes of the law. Occupational cancer forms the great bulk of litigation in regard to cancer. It has no bearing on trauma but is briefly discussed here because of its legal implication in an employee-employer relationship and because it, like trauma, is an extrinsic factor. Occupational cancer is controllable cancer and, as such, poses heavy responsibility on an employer. Criteria for the establishment of cancer as occupational hazard would depend on (1) an increase in frequency and incidence of cancer among workers of a particular industry or type of work, (2) the suspected agent must be shown to be carcinogenic, (3) the length of exposure to the suspected carcinogenic agent must be sufficiently long to warrant scientific thinking that the agent could have caused the tumor concerned.

Occupational cancers are of a variety of different types and affect various parts of the body. They may be divided into the following groups:¹⁴

1. *Direct contact tumors*: Here the agent is actually placed on the affected part. In this group come the cutaneous cancers that result from skin contact with oil, coal tars, ultraviolet light and x-ray. Radioactive particles and certain chromatic substances are inhaled into the pulmonary tree where they act directly on the cells. Tumors may be produced in the nasal passages by the same agents. Still another point of direct contact is the effect of x-radiation on deeper tissues other than the surface of the body. X-rays and radiant energy pass easily through tissue and can theoretically cause a tumor in any location.

2. *Excretory Contact Tumors*: Aniline dye workers absorb a certain amount of dye from the surface of the skin through the lungs and, as the dye is excreted through the urinary tract, it acts upon the cells of the bladder to produce tumor in that area.

13. Ulrich, *The Incidence of Leukemia in Radiologists*, 234 NEW ENG. J. MED. 45 (1946).

14. HUEPER, *OCCUPATIONAL TUMORS & ALLIED DISEASES* 12-13 (1942).

3. *Depository Contact Tumors*: Arsenic when taken internally, will be deposited in the skin and may subsequently cause cancer there. Similarly, certain radioactive substances, such as radium, are concentrated in bone and cause development of bone sarcoma.

For further details and reference on occupational cancer the reader is referred to the most recent review of this subject by Heuper¹⁵ and his textbook on occupational cancer.¹⁶

In the genesis of cancer, trauma is an external influence of little or no scientific importance but may be a frequent basis for claim. Trauma is defined in Dorland's medical dictionary and in at least one standard English dictionary¹⁷ as "an injury, wound, shock or the resulting condition" which might be said, in a broad sense, to include such things as chemical poisons for tissue since they produce injury. Generally, the implied meaning is some mechanical force of sufficient intensity to break the continuity of a skin surface or cause injury to underlying tissues by compression.

The term "traumatic cancer" generally implies a malignant tumor or the development of the neoplastic process from a single traumatic injury. It is this concept of a cause and effect relationship that is the basis for most of the litigation on the subject.

There is some medical observation to support a contention that small, repeated traumas received over long periods of time to a given part of the body may be a factor in the production of the neoplastic process. There is, however, no scientific evidence in any form to support a contention that a single injury to a given part is or can be regarded as the *only* or a contributing influence concerned with the development of the neoplastic process in that area. The only reasoning that has been used for support of such a contention is the *post hoc* type; *i.e.*, trauma to the area precedes the development of the neoplastic process there, therefore, it is the cause of the disease.

MINIMAL CRITERIA FOR ESTABLISHING A CAUSAL RELATIONSHIP BETWEEN TRAUMA AND CANCER

The following minimal criteria will be found useful in evaluating cases and claims for legal premise. A hypothetical case is cited for use in applying these criteria as listed below.¹⁸

A 50 year old man was hit on the forearm by a falling piece of rock while working in a mine. Five days later he noted a swelling in the precise area. This was subsequently shown to be a fibro-

15. Hueper, *Environmental Cancers: A Review*, 12 CANCER RESEARCH 691 (1952).

16. HUEPER, *OCCUPATIONAL TUMORS & ALLIED DISEASES* (1942).

17. WEBSTER'S NEW COLLEGIATE DICTIONARY (2d ed. 1951).

18. Pack, *The Relation of Cancer to Trauma*, 3 COMPENS. MED. 5 (1950).

sarcoma of soft tissue by biopsy diagnosis rendered by a qualified pathologist taken two days after the swelling appeared. Although the arm with the sarcoma was surgically removed six days following the receipt of the pathologist's diagnosis, the man died of metastases six months later. A post mortem examination performed by a pathologist verified the diagnosis of metastatic fibrosarcoma of a type similar to that removed from the arm at the site of the claimed injury. The fibrosarcoma was typical of soft tissue sarcomas found in subcutaneous tissues. The deceased man's family claimed negligence on the part of the employer as being responsible for the accident which was claimed to have caused the sarcoma and his death.

Point 1. *The Previous Integrity of the Wounded Part.* The possibility of tumor existing in the site prior to the trauma must be excluded. In the above cited case, this would be difficult. The patient would probably claim that the arm was in good functional condition with no previous swelling in the area. It would be most fortuitous that unbiased testimony could be obtained; *i.e.*, a physician who examined the arm a few days before for some other reason and could state that the arm did not have a tumor.

Point 2. *Proof of Injury.* A medical examination immediately after the trauma can establish the existence of a bruise, skin laceration, recent hemorrhage or fractured bone. Demonstrable evidence such as one or more of these would be necessary for legal support of the injury. This is easily obtained by competent medical examination of the injured area. In the hypothetical case, however, there was no medical examination of the injured area immediately after the accident to establish that trauma to the area was of sufficient degree to be a theoretical basis for causation of the neoplastic processes. Unless physical injury or damage is established, single trauma as the causation of the disease should not be given even theoretical possibility because minor injuries are so frequent that any person easily recalls a small blow or injury to a particular part of the body.

Point 3. *Time Interval Elapsing.* The tumor must follow in a reasonable period of time following the trauma. A minimum of four weeks with a maximum of four years would cover theoretical possibilities. In tumors induced in laboratory animals with carcinogenic substances where the life span of the animal (mouse) may be as little as one-twentieth as long as man's, tumors are rarely induced in less than four weeks. In this case, the two day interval between the receipt of the trauma and the appearance of the cancer excludes the scientific possibility of any causal relationship.

Point 4. *Site of Injury.* The type of tumor that is found must be judged to be reasonable and logical for the location of the trauma. An epithelial tumor characteristic of the carcinomas found to arise in the gastrointestinal tract, stomach or colon, if found growing in soft tissues of the arm, would exclude the possibility of trauma in that area as its cause. In the above case, the tumor type was a sarcoma which is consistent with a tumor primary in the location of the claimed trauma.

Point 5. *Character or Structure of the Growth* should be of a relatively simple type. This is a straight-forward histologic type about which pathologists would not disagree as to the precise terminology used in the classification. The hypothetical case would qualify since it was a characteristic fibrosarcoma of soft parts.

The hypothetical case would qualify only on Point #4 and Point #5. Since all five points are necessary for qualification of admission of scientific possibility, the case is, therefore, scientifically disqualified. The above criteria must be met if any case is to be considered on a high scientific level for a relationship of a single trauma to the development of cancer. Many rare events can happen, such as the coincidence of injury in an unusual part with the subsequent development of tumor as illustrated in the hypothetical case, but if the above criteria are applied, it will be possible, in all instances, to evaluate the case in scientific reasonable terms.

One frequently sees reference in legal cases to the use of evidence called "bridging symptoms" in establishing relationship of causal factors to the genesis of disease. As applied to cancer, these are symptoms that will continue to give evidence of the continuance of the disability from the time the injury is first sustained to the time when the tumor is known to be present and established by biopsy. Points in bridging symptoms used are continuity of pain, the persistence of swelling, persistence of induration, or ulceration following the injury. It may be possible to build a strong case on the bridging symptoms, but if the aforementioned criteria are used, it will always be possible to evaluate it honestly under the best scientific attitude of proof.

POSSIBLE RELATIONSHIP OF CANCERS TO REPEATED TRAUMAS (CHRONIC IRRITATION AND TRAUMATIC INSULTS TO SKIN SUCH AS THERMAL BURNS)

In the following unusual types of trauma, medical opinion has recognized a possible causal relationship:

1. If skin burns are regarded as trauma, then burns in some instances may be responsible for causation of some skin cancers. So-called first and second degree burns are not incriminated; only third degree burns and more particularly those where there has been charring of tissue

are important in this respect. The implication is, that with charring of the tissue, some carcinogenic substance may be produced. Cancers arising in scars from burns are called "Marjolin ulcers" because of the original classic description of the disease by Marjolin, a French surgeon.¹⁹ In certain Oriental peoples (shepherds of Kashmir and the Japanese), who carry earthenware receptacles of coals close to their bodies, deep burns in the anterior abdomen are common occurrences. Scars from these burns show a high incidence of cancer.

2. Chronic ulcers, particularly those on the leg caused by poor circulation of varicose veins, are not known to be associated with malignant transformation. Unless the ulcer resulted from a burn scar, it would be difficult to get medical opinion to support the claim that there was any relationship. Frequently, skin cancer will produce an ulcer that will remain indolent for a long period of time. In this instance, the patient and perhaps the attending physician might regard what actually was cancer originally as a malignant transformation in a chronic benign indolent ulcer.

3. In parts of the world where man is afflicted with parasites involving the bladder and liver, there is a high incidence of cancer developing in these organs. These conditions are the liver flukes found in Orientals, and blood flukes of the bladder developing in persons living in tropical areas, particularly Egypt. The exact and precise mechanism of genesis of these types of cancer is not known, but a causal relationship appears reasonable.

4. Chronic irritation to mucous membrane surfaces, such as a broken tooth which rubs against the lip or cheek, has been thought by some medical men to be significant in causing the neoplastic process. There is no scientific explanation but only the observed occurrence of the cancer frequently at those sites.

These examples merely serve to show that small repeated trauma has received some consideration in medical opinion as possibly being significant in the genesis of the neoplastic process. In all instances, the precise mechanism of the repeated trauma is incompletely understood.

TRAUMA AS A CAUSAL FACTOR IN TRANSFORMATION OF BENIGN TUMORS TO MALIGNANT TUMORS

This event is among the rare occurrences in the natural history of tumors²⁰ but is a field of high interest in regard to litigation. The patient is quick to attribute a recorded injury sustained to a benign tumor of long standing and observed existence as a cause for its change to a

19. Treves and Pack, *The Development of Cancer in Burn Scars*, 51 SURG. GYNEC. OBST. 749 (1930).

20. EWING, *NEOPLASTIC DISEASE* 52 (4th ed. 1940).

rapidly growing malignant tumor. Here, the pathologic study by a competent pathologist, with particular emphasis paid to the histologic classification of the tumor type, is of paramount importance. If a patient is known to have a fibroma (benign tumor of fibroblast) for a long time, verified by biopsy, and a carcinoma (malignant tumor of epithelial cells) is also shown by biopsy to be present in the same area, there is not even theoretical basis for claim. Fibromas, if they undergo malignant transformation, produce fibrosarcomas and not carcinomas. On the other hand, if a long-standing benign fibroma is severely injured by trauma, grows rapidly, and is confirmed as fibrosarcoma by biopsy, there would be theoretical basis for claim. The important point to remember is that benign tumors do undergo malignant transformation at infrequent intervals, resulting in increased bulk of the tumor by the rapidly dividing malignant cells. Such a tumor, recently increased in size, is more easily injured and the pain caused by death of cells and hemorrhage into surrounding tissue is more likely to be noticed by the patient. In many such claims, it is possible to obtain evidence to indicate that the tumor had undergone the malignant transformation first.

There is one type of cancer in which there is some controversial medical opinion regarding traumas of a repeated type causing malignant transformation. This is the so-called "malignant melanoma" (black cancer of skin) that develops in benign black pigmented moles, commonly seen on the external surface of the body. It has been claimed that trauma to moles from such things as repeated shaving cuts, or injury resulting from cautery removal by a physician can institute malignant transformation in the benign mole. The best medical interpretation of such cases is that there was an original malignant transformation in the mole which caused it to become more prominent and, therefore, more likely cut in shaving and noticed by the patient. In the case of cautery, the malignant change already existed in the mole and was undetected and unsuspected by the patient and physician. In other words, the lesion was already malignant and had spread beyond the area of cautery removal, so the cancer obviously was not all killed and therefore recurred. This would be the basis for interpretation of the claim that cautery caused the malignant change. The only evidence attesting in any part to that fact that trauma may change pigmented moles into malignant melanoma, is the high frequency of malignant change in moles found on the soles of the feet, inferring that it is the trauma to the lesion by pressure from walking.

EXISTING CANCER AGGRAVATED BY TRAUMA

It is herein assumed that the patient has an existing cancer and the question of trauma regarding the initiation of the disease is not concerned. Trauma may assume an important role regarding an em-

ployer's liability if the injury results from negligence on his part. Cases, well documented with medical testimony, show that single or repeated traumas have hastened the death of a person suffering from cancer. Some forms of cancer exist for years before causing death and patients may pursue gainful occupations during this time. Let us first consider the nature of the cancerous growth. Cancer generally weakens the strength of the tissue in the organ it involves. If cancer is growing in the wall of the stomach, it may be of a softer tissue than the stomach and cause a weakened point for rupture by replacing the stronger tissue. Cancers that weaken the wall of the stomach, or large intestine where the wall lies free in the peritoneal cavity are examples. Any trauma to the abdomen causing increased pressure could be the direct cause of the rupture of stomach or large intestine when weakened by cancer and could cause acute peritonitis. The trauma could then be shown as the inciting cause in the development of peritonitis and ensuing death, if the peritonitis was not successfully treated. If, on the other hand, the patient recovered from a ruptured cancer in the wall of the colon after the development of peritonitis that was removed at the time or later, it could be argued against the plaintiff that the trauma actually saved or prolonged his life. The following is a basis for this assumption:

It could be assumed that the patient would not have known of the existence of a cancer for a much longer period of time had not the trauma produced a peritonitis that led to its removal. If the disease was in an operable stage with reasonable outlook for cure or long term palliation, it would be argued that the patient's life was saved or lengthened materially since the disease might not have been detected until it was inoperable and an incurable condition.

TRAUMA AND THE SPREAD OF CANCER

This question always arises in connection with biopsy and is an occasional topic of controversial medical writing. Although there may be theoretical basis that cutting into an existing cancer or single or multiple traumas to the cancer could push small masses of cells into blood or lymph channels, there is little or no scientific evidence from clinical studies and animal experiments to support it. On the other hand, if claimed, it would be extremely difficult to disprove by scientific evidence. Claims have been made by patients that a rapid spread occurred after a physician had taken a biopsy from a tumor. Claim for damages on such basis would be poorly founded. It could possibly be argued that the physician might have been guilty of malpractice if he had not taken a biopsy when clear clinical symptoms existed leading him to suspect cancer, since this is the most reliable method known to the medical profession to detect the presence or absence of neoplastic

disease. The physician might be held negligent as to the type of therapy recommended with regard to rapid spread and the blame placed on this, but the blame might also be placed on the patient who may have chosen a less disfiguring operation than a more radical one which offered better hope of cure. Obviously such cases would need to be evaluated by expert medical opinion. In regard to the biopsy being a procedure of importance in the spread of cancer, the reader is referred to the excellent article by Maun and Dunning reporting scientifically controlled experiments in animals.²¹ The conclusions of these investigators were that the procedure was not detrimental in regard to prognosis and the dissemination of tumor cells.

SUMMARY

A review has been made of extrinsic factors of known importance in regard to cancer genesis with particular emphasis on trauma. Terms used by the medical profession to denote a cancerous process have been defined and discussed. Many known extrinsic factors can be the sole cause or the contributing cause for the development of cancerous condition in man and animals. The present bulk of scientific knowledge regarding the origin of the cancerous process is in this group. Unfortunately, these types comprise only one per cent of all human cancer. External influences of proven significance, when occurring in industry, pose problems of liability on the part of employers to employees in seeing that working conditions are such that exposure does not result. This group called "occupational cancer" is the largest single group of cancer cases that come to litigation. Trauma, as a claimed extrinsic factor in cancer genesis, is discussed in two parts. The first is the part played by a single trauma as responsible for the institution of the cancerous process and, second, the part of repeated traumas (chronic irritation) or insults to skin such as burns as a factor in the causation of the disease. There is no scientific evidence to support the contention that single trauma can produce the neoplastic process. Certain conditions such as old burn scars and small traumas in the form of chronic irritation in the mouth have some basis for consideration as being significant in the causation of a cancer in those areas. The following qualifying criteria for critical review and scientific evaluation of claims citing trauma as a factor in cancer genesis should be used in all cases.

1. The possibility of tumor existing in the site prior to trauma must be excluded.
2. Evidence of injury such as a bruise, laceration or fractured bone must be established.

21. Maun and Dunning, *Is Biopsy of Neoplasms Dangerous? Experimental Study*, 82 SURG. GYNEC. & OBST. 567 (1946).

3. The tumor must follow the injury in a reasonable period of time.
4. The type of tumor found must be logical for the site of trauma.
5. The cancer must be of a simple recognizable type and not raise questions of controversy in its classification.

Existing cancers can be aggravated by trauma and the expected life span of the individual shortened by traumatic injury. Liability in such cases would be determined by competent medical opinion as to the reduction of life span resulting from the trauma in the patient suffering from cancer. This would obviously be in sharp contrast to the normal life span if the claim was for the induction or causation of the cancer. In any litigation regarding cancer, establishment of the diagnosis is the first step. Courts have upheld the conclusion that tissue removed by biopsy and shown to contain cancer cells is the only prima facie evidence that the patient is suffering from the claimed disease (cancer).

CONCLUSION

There is no scientific evidence to indicate that a single trauma can produce a cancerous change in tissues. For purposes of claim and litigation, all such cases may be scientifically evaluated by established criteria. Prima facie evidence for the existence of cancer must be obtained from biopsy and microscopic study of tissue removed from the suspected cancerous area. High courts have repeatedly upheld this view.