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Mercurochrome

dibrom-oxymercuri-fluorescein-sodium



HYNSON, WESTCOTT & DUNNING, INC.
BALTIMORE, MD.

MERCUROCHROME

H. W. & D.

(dibrom-oxymercuri-fluorescein-sodium)



Hynson, Westcott & Dunning, Inc.

Main Office and Laboratories, Baltimore, Md.

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SUMMARY OF CONTENTS

	PAGE
Chapter I—Description of the Drug.....	6-11
Section 1—Chemistry.....	6-7
Section 2—Dispensing Notes.....	7-11
Incompatibilities.....	7
Preparation of Starch Paste.....	8
Preparation of Ointment.....	9
Preparation of Alcoholic Solutions.....	9
Preparation of Skin Disinfectant Solution.....	9
Removal of Mercurochrome Stains.....	9-10
Bleach for Stains on Colorless Cotton or Linen.....	10-11
Thermostability.....	11
Chapter II—The Toxicity of Mercurochrome, Topical Use.....	12-13
Chapter III—Irritability.....	14-15
Chapter IV—Bacteriology.....	16-19
Section 1—General Bacteriology.....	16-18
Section 2—Preoperative Skin Disinfectant Solution.....	19
Chapter V—The Use of Mercurochrome in Obstetrics.....	20-22
Chapter VI—Mercurochrome in Ophthalmology.....	23-25
Chapter VII—Urology.....	26-30
Section 1—Urethritis.....	26-28
Section 2—Cystitis.....	28
Section 3—Prostatitis.....	28-29
Section 4—Pyelitis.....	29
Section 5—Infections of the Genito-Urinary Tract (Male).....	30
Chapter VIII—Infections of the Genito-Urinary Tract (Female).....	31-36
Section 1—General.....	31-34
Section 2—Vulvovaginitis.....	35
Section 3—Trichomonas Vaginitis.....	36
Chapter IX—Other Uses.....	37-38
Section 1—Otitis Media.....	37
Section 2—Empyema.....	37-38
Section 3—Fungus Infection of the Skin.....	38
Chapter X—The Intravenous Use of Mercurochrome.....	39-42
References.....	43-47
Directions for Preparing Solutions.....	48

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THE purpose of this booklet is to outline briefly the present status of Mercurochrome. During the past fifteen years, the various uses of Mercurochrome have been described and discussed in approximately four hundred papers. In addition to such publications, dealing directly with Mercurochrome, comments on its merit have occurred incidentally in many other articles. There is no question that in some fields Mercurochrome has proved to be valuable, while in others there is some confusion due to conflicting reports.

It has, therefore, seemed to us that an attempt to correlate the more important publications on this subject might prove to be of some value to the physician. Data have been gathered and presented in such a way that the results obtained by a number of investigators may be compared and an opinion formed as to the probable effectiveness of Mercurochrome in any particular field.

The booklet is divided into a number of sections in order that the physician may refer readily to the application in which he is particularly interested without having to search through irrelevant material.

The first section is devoted to a brief consideration of the chemistry of Mercurochrome and presents limited information for the guidance of those who may desire to use it in combination with other drugs. Other sections deal with the bacteriology of Mercurochrome, its toxicity, the physical and

physico-chemical properties which appear to enhance its usefulness, and the various topical, internal and chemo-therapeutic applications of the drug.

Statements are made only where they appear to be justified by clinical and laboratory evidence. As far as possible such results have been verified in our own research departments in consultation with university and official laboratories.

It has become apparent that the value of any therapeutic agent can be determined only by a prolonged period of clinical observation. So little is known about the action of such agents in the body, that it is at present impossible to devise laboratory tests which will demonstrate infallibly the effectiveness of a drug in the human body or even in a wound. Laboratory experiments provide at best only an indication of what may occur. Muir and Ritchie¹ state in their text-book of bacteriology that, "Laboratory experiments alone cannot give accurate information as to the action of antiseptics within the living body, *e.g.*, in a wound." When the laboratory worker reports that a certain compound is an extremely powerful germicide in the test-tube, we are by no means assured that we shall obtain the same results in the treatment of local or general infections. On the other hand, a substance, which under laboratory conditions appears to be but moderately effective, may in practice be most valuable. Many factors other than toxicity for bacteria play a part. Thus toxicity for the body as a whole, action on body proteins, the modifying effect of serum, action on phagocytosis, antibody formation and other immunological processes, irritation and penetration would all appear to be important considerations.

The consensus of opinion at the present time seems to be that the chief value of antiseptics lies in reducing the number

and state of activity of bacteria to a level wherein the degree of immunity of the individual is adequate to combat the invasion. The application of a substance which produces this effect without undue destruction of tissue cells is clearly preferable to treatment with more powerful but also more irritating preparations.

Mercurochrome not only prevents or inhibits growth of bacteria; it is also an efficient germicide. Its use, therefore, insures a considerable margin of safety.

Mercurochrome has been in the hands of the medical profession for more than fifteen years, and we believe that it should now be possible, by analysis of results, to form a reasonably accurate opinion as to its efficiency in various fields.

Chapter I

DESCRIPTION OF THE DRUG



SECTION I—CHEMISTRY

THE initial compound used in the preparation of Mercurochrome is fluorescein. Fluorescein, which is a dye-stuff, is carefully purified and then brominated. The dibrom-fluorescein obtained in this way is in turn purified and afterwards treated with mercuric acetate in such a manner that the insoluble or acid form of Mercurochrome is formed. The disodium salt, the soluble Mercurochrome, is then prepared. All traces of inorganic mercury are removed and the product carefully standardized before being sent out to the physician.

Chemical analyses are conducted at various stages of the process and the resulting product is submitted to a number of different examinations in order to insure uniformity of composition. The material when ready for distribution is of a very high degree of purity.

Mercurochrome is the disodium salt of dibromhydroxy-mercurifluorescein. It has a molecular weight of 750.4, a mercury content of 26.7 per cent, and contains 21.3 per cent bromine. The mercury exists in close chemical combination with the organic molecule so that there is no free or ionic mercury present, such as is represented in bichloride of mercury and other toxic inorganic salts. Tests for inorganic mercury show that no free mercury exists in Mercurochrome.

Mercurochrome is itself a dye. The stain and antiseptic action are both properties of the same molecule.

SECTION 2—DISPENSING NOTES

Mercurochrome is precipitated immediately from aqueous solutions more acid than pH 4.8; in solutions of pH 5.4 to pH 4.8 precipitation takes place only slowly, the complete process requiring from six to eight hours. It is thrown out of solution by all acids, including tannic acid and boric acid.

A gel may sometimes form, especially in concentrated aqueous solutions. It may be remedied by the addition of sodium carbonate (Na_2CO_3) in the proportion of 1 per cent. Sodium carbonate should always be used in the preparation of solutions containing 10 per cent or more of Mercurochrome.

Incompatibilities

Mercurochrome is incompatible with all strengths of ethyl alcohol above 50 per cent, and with iso-propyl alcohol, ethyl acetate, benzyl alcohol and iso-butyl alcohol. It is almost insoluble in pure iso-butyl alcohol.

Mercurochrome is not compatible with glucose, but Redewill, Potter and Garrison² have reported that the addition of this substance to solutions injected by the intravenous route reduces the subsequent reaction. This finding has been confirmed by Macht and Harden.³ Solutions containing glucose must be prepared immediately before use. (For fuller information refer to page 39.)

Mercurochrome is incompatible with all reducing sugars and honey, aldehydes and all other reducing agents, all mineral acids, most inorganic acids, all salts having an acid hydrolysis, and acid salts of organic acids, all heavy metal

salts and substances capable of liberating chlorine or other halogens, most alkaloids and acid solutions of alkaloids, aqueous solutions of alypin, apothesine, benzocaine, butyn, cocaine, phenacaine, procaine, propaesin, tropococaine and stovaine.

In dispensing Mercurochrome, incompatibility with any other substances which are to be employed with it may readily be determined. If the mixture is prepared and allowed to stand overnight, precipitation will have occurred by the following morning if an incompatible substance is present. When no precipitate is observed, it may safely be concluded that Mercurochrome is not incompatible with the other substances.

A slight sediment which may be observed when the aqueous-alcohol-acetone solution is allowed to stand is of no significance. *It has been found that solutions many months old are equally as effective as freshly prepared solutions.* The sediment may be removed by filtering.

Preparation of Starch Paste

Dissolve 10 grams of Mercurochrome in 75 cubic centimeters of distilled water and add to a very fine and smoothly ground suspension of 12 grams of starch and 25 cubic centimeters of water. Then add 100 cubic centimeters of glycerin, stir thoroughly, and heat in an enameled vessel for one minute after boiling begins. The mixture must be vigorously stirred during the entire period of heating to prevent scorching. When cold, the mixture sets to a jelly. This paste does not keep indefinitely; it should be freshly prepared and should not be used if it becomes leathery in consistency.

Preparation of Ointment

Add a solution of 5 grams of Mercurochrome in 5 cubic centimeters of water to 60 grams of lanolin. When the solution is thoroughly mixed with the lanolin, add 30 grams of petroleum jelly (vaseline) and again mix thoroughly.

Preparation of Alcoholic Solutions

A 2 per cent solution of Mercurochrome in 50 per cent alcohol is suitable for most purposes. The powder should be dissolved in water first and the appropriate amount of alcohol added when solution is complete. Mercurochrome should not be used in solutions containing more than 50 per cent alcohol. Lower concentrations are entirely satisfactory.

Skin Disinfectant Solution (Surgical Solution)

Dissolve 2 grams Mercurochrome in 35 cubic centimeters distilled water containing 0.1 gram sodium carbonate, add 55 cubic centimeters 95 per cent alcohol, U. S. P., and 10 cubic centimeters acetone, U. S. P. Bacteriological investigations prove that stock solutions may be kept indefinitely. The slight sediment which will form after a few hours may be filtered off and is not significant from a bacteriological point of view.

Removal of Mercurochrome Stains

Mercurochrome stains on the skin may be removed by rubbing the part with a 2 per cent solution of potassium permanganate, followed by an application of 5 per cent solution of oxalic acid. Care should be taken that the oxalic acid does not come in contact with the eye or any sensitive mucous membranes.

Hypochlorite solutions, such as that of Carrel-Dakin or of Labarraque, provide the most effective means of removing Mercurochrome stains. Labarraque's Solution is stronger and therefore more effective, but is more injurious to the skin. It should usually be diluted with water in the proportion of at least one part to four.

Application of these solutions to the hands should be followed by free use of a hand lotion.

Bleach for Stains on Colorless Cotton or Linen

Careful investigation has proved that while the stains of Mercurochrome on linen are unsightly they do not damage the fibres of the material and may be removed without harm if care is exercised. Mix one volume of Labarraque's Solution (chlorinated soda) with four volumes of water. Immerse the stained fabric and allow to soak for about two minutes. Without removing the fabric, add one volume of 5 per cent acetic acid (approximately the strength of vinegar) and mix thoroughly. The stain disappears rapidly and should be completely removed in one minute.

If a large quantity of stained fabric is to be treated, it may be necessary to increase the strength of the Labarraque's Solution or to use a more concentrated acetic acid solution. In this case, the stock Labarraque's Solution may be diluted with water in proportion of one to two, or the strength of acid increased to 10 per cent.

As soon as the red color disappears, the fabric is removed and washed thoroughly in hot water.

Fresh solutions should be used for each bath of fabrics treated. Enameled vessels or graniteware should be used for

the decolorizing bath, since metals are attacked by the solutions.

Stains on silk materials may be treated with dilute Carrel-Dakin Solution, but only when the material is not colored.

The disagreeable odor may, to a great extent, be removed by the addition of a small amount of acid to the water with which the materials are finally rinsed.

NOTE: If desired, any of the commercial hypochlorite solutions may be used instead of those mentioned, and vinegar may be employed for acidifying purposes. The correct proportions in such cases must be determined by experience.

It is important to soak the textile in the hypochlorite solution before acidifying.

Thermostability

Only moderate heat is necessary to dissolve Mercurochrome in water. Solutions should not be heated above 70°C., since at higher temperatures the compound is not stable.

Solutions are self-sterilizing and need not be boiled or autoclaved before intravenous injection. Solutions intended for intravenous use should, however, be prepared with sterile water and it is desirable to use the specially prepared Mercurochrome. Mercurochrome is available in sealed vials for this purpose. It is advisable to administer only freshly prepared solutions intravenously because old solutions sometimes contain a slight precipitate.

Mercurochrome in the solid form and in aqueous solution retains its full germicidal activity indefinitely. *Solutions examined five years after preparation have proved to be equally as germicidal as freshly prepared solutions.* (Reddish.⁴)

Chapter II

THE TOXICITY OF MERCUROCHROME

TOPICAL USE

THE toxicity of any compound which is used as a topical application in the treatment of wounds or other lesions depends finally on its effect after absorption into the blood stream. Toxic effects which may be observed must depend on the extent of such absorption. The maximum quantity of Mercurochrome which could be absorbed from the treatment of extensive injuries, even supposing the whole application to be so absorbed, is so much less than the smallest quantity that has been given by the intravenous route, that it would be surprising if any toxic effects were noticed. There are only two reports (Cleveland⁵ and Lustman⁶) of toxic symptoms following topical application of Mercurochrome. Such reactions are extremely rare and would appear to be due to idiosyncrasy.

Many articles dealing with the liberal use of Mercurochrome on extensively denuded surfaces have appeared in various journals. In a number of instances comment is made on the absence of reaction and in no case has there been an unfavorable report.

A few references to the extensive use even of concentrated solutions will serve to illustrate the safety of free local applications of the 2 per cent solution.

Brady⁷ has used 20 per cent solutions in the endocervix and has never observed symptoms of toxic absorption. When such concentrated solutions are used, however, it is probable that there is some local reaction.

Poska,⁸ whose experience extends over a period of several years, applies Mercurochrome in solid form to the cervix. Here again there were no signs of toxic effects in patients.

Bray⁹ has concluded that the toxicity of Mercurochrome is low and that it is thus a valuable antiseptic in treating a variety of infections even in cases where there is not free drainage, while Williamson,¹⁰ in his work on the treatment of gonococcus infection, found that Mercurochrome was non-toxic for patients.

Many other similar references might be cited, indicating that the toxicity of Mercurochrome when used locally is very low.

Chapter III

IRRITABILITY

AQUEOUS solutions of Mercurochrome have been used in a variety of conditions on most sensitive surfaces without irritation or local destruction of tissues.

Young, White and Swartz,¹¹ found in their original investigation of Mercurochrome that 5 per cent solutions may be used in the urethra and even retained in the bladder of patients suffering from urinary infections without undue discomfort. In a few severe cases there was transitory pain. It has also been observed, however, that considerable discomfort is sometimes experienced in cases with residual urine. Davis,¹² Nyberg¹³ and Sexton¹⁴ reported that urethritis, and other infections of gonococcus origin, and cases of pyelitis during pregnancy, may be treated with Mercurochrome. One and 2.5 per cent solutions have been used in many cases by Davis.¹⁵

Von Lackum and Hager¹⁶ employ pure crystals of the drug in the cervical os in the treatment of cervicitis. The vault of the vagina in such cases is swabbed with a 1 per cent solution. As a result of a practice extending over a period of several years, Poska⁸ also has stated that finely powdered Mercurochrome in the solid form can be used in the cervix in cases of cervical gonorrhea without injury or irritation.

Many others, notably Pemberton,¹⁷ Barringer¹⁸ and Rucker,¹⁹ have used Mercurochrome in the vagina in the treatment of

gonorrhea. Brady²⁰ has employed a 20 per cent solution in the endocervix in the treatment of gonorrheal endocervicitis. There was no record of irritation in any of these cases.

Clapp and Martin²¹ reported that a 2 per cent solution may be used with impunity in the treatment of ophthalmia neonatorum, while Lancaster, Burnett and Gaus²² have used similar solutions in the care of acute infections of the conjunctiva. Mercurochrome is the least irritating antiseptic for ophthalmological purposes, according to Boeckmann,²³ and Weymann²⁴ is of opinion that the 2 per cent solution, while being powerfully antiseptic in ophthalmic therapeutics, is unusually non-irritating.

Borovsky²⁵ has used 2 per cent solution in the treatment of erysipelas in infants.

As a result of a study of various antiseptics used in the lavage of the renal pelvis, O'Connor²⁶ reported that Mercurochrome was the least irritating.

There are many other published statements to the effect that solutions of Mercurochrome may be used even on the most sensitive surfaces without causing irritation or discomfort to the patient.

We have carried out in our laboratories a number of experiments designed to determine the degree of irritation produced by Mercurochrome solutions. Various strengths have been instilled into the eyes of rabbits, but no irritation or congestion followed this procedure.

In view of the almost complete lack of irritating properties, Mercurochrome may be used with safety in regions where the tissues are delicate and sensitive.

Chapter IV

BACTERIOLOGY



SECTION I—GENERAL BACTERIOLOGY

THE action of Mercurochrome against a great variety of organisms has been investigated. The results have been very favorable. Mercurochrome, in common with all known antiseptics, varies in its action on different bacteria. It is, however, active in the concentrations generally used against all the organisms ordinarily involved in infections with which it has been tested.

Young, White and Swartz,¹¹ in their first paper on Mercurochrome, stated that in the presence of urine Mercurochrome killed *B. coli* in a dilution of 1:800 in one minute, while a 1:1000 dilution killed *Staphylococcus aureus* in the same time under similar conditions.

Swartz and Davis²⁷ later reported that Mercurochrome was active against the gonococcus in a dilution of 1:16,000 and killed this organism in five minutes in a dilution of 1:4,000.

Eyre,²⁸ of St. Bartholomew's Hospital (London), in conjunction with Notton and Sir William Pope, has shown that the 2 per cent solution diluted seventy times will prevent the growth of the *Bacillus coli* in nutrient media, while the growth of a highly virulent *Streptococcus longus* (haemolyticus) was prevented by a similar solution diluted 160 times.

Young,²⁹ with Scott and Hill, found that solutions con-

taining only 1 part of Mercurochrome in 40,000 parts of water will prevent bacterial growth. It has also been shown that Mercurochrome is very active against organisms of different types such as *Staphylococcus aureus*, the gonococcus, *Streptococcus equinum*, *Streptococcus ignavus*, and those of the colon-typhoid-dysentery group.

Hench, Snell and Greene³⁰ stated that a solution of Mercurochrome containing one part in twenty thousand parts was bactericidal for *B. coli*.

Hill and Scott³¹ found that the bile of rabbits is bactericidal for *B. typhosus* after intravenous injections and found that Mercurochrome was extremely active against the colon-typhoid-dysentery group and against *Vibrio comma*.

According to Smith,³² *B. coli* is killed in one minute by a 1:200 solution of Mercurochrome in 50 per cent serum, while under the same conditions, *Staphylococcus aureus* and *B. pyocyaneus* are killed in a dilution of 1:90 and the pneumococcus in a dilution of 1:50.

Williamson²⁰ has reported that Mercurochrome in weak serum kills the gonococcus in twenty minutes in a dilution of 1:16,000.

Lancaster, Burnett and Gaus²² reported killing of *Staphylococcus aureus* in one minute by a solution of Mercurochrome containing one part in one thousand, and found that a 1 per cent solution destroyed this organism in ten seconds or less. They further stated that Mercurochrome was active against *Staphylococcus aureus* in serum in a dilution of 1:10,000 in from six to ten minutes.

Reddish⁴ found that the bactericidal efficiency of Mercurochrome solutions does not decrease when such solutions are kept at room temperature for a period as long as five years.

Favorable reports have also been published by Kolmer,³³ of

the University of Pennsylvania; Redewill, Potter and Garrison,³⁴ of the United States Navy; and by many other investigators such as Gatch, Trusler and Owen;³⁵ Hill and Colston;³⁶ and Reddish.³⁷ Charles J. White,³⁸ of Harvard University, states that, "I have confidence enough to say that in my use of Mercurochrome I have found a drug superior to any I have tried in this most obstinate and refractory disease. Mercurochrome is not 100 per cent perfect, but it is proving far more effective than any drug I have employed before." (Epidermophytosis.)

The value of Mercurochrome in preventing infections in prostatectomy cases has recently been made the subject of a publication by Harris.³⁹ It is stated that, "After more than three years' use of Mercurochrome solution, I have found that secondary complicating infection has not occurred, other than slight infections about the drainage tube." Details of technic are given.

Mercurochrome passes the standard tests prescribed by the Food and Drug Administration of the Bureau of Chemistry. It is included in New and Nonofficial Remedies, the official publication of the American Medical Association.

The extent to which Mercurochrome may be diluted and yet retain activity will become obvious when it is pointed out that in order to obtain some of the solutions mentioned in this summary, the 2 per cent solution was diluted 2,000 times.

In attempting to make comparative estimates of the efficiency of different antiseptics, a number of factors other than direct germicidal efficiency must be taken into consideration. Some of these factors are toxicity, irritation, and destruction of tissue cells. The germicidal efficiency of Mercurochrome is illustrated by the experimental work which has been reviewed. It will be shown in the following sections that the drug is non-irritating and non-toxic when used in wounds.

SECTION 2—PREOPERATIVE SKIN DISINFECTANT SOLUTION (SURGICAL SOLUTION)

Some confusion has arisen as the result of the use of a solution of Mercurochrome in alcohol, acetone and water for preoperative skin disinfection. This solution was devised by Scott and Hill,⁴⁰ of the Brady Urological Institute of the Johns Hopkins University, to overcome the peculiar difficulties in disinfecting the unbroken skin quickly and efficiently.

The aqueous solution of Mercurochrome is not suitable for preoperative skin disinfection because it dries very slowly and also because there are no solvents present which will dissolve the fatty material and epithelial debris always found on the skin surface. Scott and Hill decided, therefore, to include alcohol and acetone to promote penetration through the fatty layer and also to induce more rapid drying. *The aqueous solution is entirely satisfactory for wound disinfection*, while the preoperative solution is suitable only for use on the unbroken skin. *The latter solution should not generally be used in the treatment of wounds* because it is somewhat irritating to, and destructive of, the more delicate cells exposed in a wound.

Chapter V

THE USE OF MERCUROCHROME IN OBSTETRICS



WITHIN recent years Mercurochrome has been used extensively as an antiseptic in obstetrical work, and results have been encouraging.

DeLee⁴¹ in the Year Book of Obstetrics and Gynecology for 1928, writes that, "As a general statement one should say that our natural aversion to the routine use of vaginal antiseptics, which was founded on their uselessness and harmfulness of former years, should not preclude our attempt today to maintain an aseptic birth canal by means of newer and certainly better germicides."

Williams,⁴² in the sixth edition of his treatise on obstetrics, commented favorably on the Mercurochrome methods of preparation and described the method used in his service.

In July, 1926, Bessesen⁴³ published a paper on puerperal infection, describing his method of preparing obstetrical patients, and stated that the technic had given excellent results. In this connection it is interesting to note that 20 per cent solutions have been applied to the cervix in treating cervicitis, by Brady,⁷ and even pure crystals were used by Von Lackum and Hager,¹⁶ and Poska⁸ for similar purposes. No irritation was noted in any case.

Bessesen,^{44, 45} in 1930, gave a more detailed description of his method of preparing obstetrical patients with Mercuro-

chrome. He concluded that "there is need for more investigation along the line of antiseptics for use on mucous membranes. If an efficient mild antiseptic, non-injurious to the mucosa, but bactericidal, is applied to the perineum, vulva and vaginal mucosa, and repeated at intervals during parturition, infections during the puerperium will be reduced approximately 50 per cent."

In a recent article Bessesen⁴⁶ stated that, "Any obstetrical cases, whether operative or non-operative, should receive vaginal sterilization," and that "the use of vaginal sterilization will reduce morbidity from infection at least 50 per cent, and when infection does occur, it is commonly less severe."

In 1928, Bloss,⁴⁷ Kane,⁴⁸ and Wilson⁴⁹ also reported favorably on the use of Mercurochrome in preparing obstetrical patients.

Sellers and Sanders,⁵⁰ in 1929, stated that Mercurochrome had "been a great factor in lowering . . . morbidity," while Margeson⁵¹ found Mercurochrome to be of value in the preparation of patients for Cesarean section. The results of Kickham⁵² also support those of other investigators.

In a paper on the value of Mercurochrome as an antiseptic in obstetrics, Baldwin⁵³ reviews the results of 300 consecutive hospital deliveries. His true obstetric morbidity without Mercurochrome was 20 per cent. With an external application of Mercurochrome, the morbidity was 17.6 per cent, while the combined external and internal treatment with mercurochrome gave a morbidity of 14.7 per cent. There was thus a reduction from 20 per cent to 14.7 per cent in the morbidity rates. These figures, calculated according to the American College of Surgeons' standard, are somewhat higher than those reported by other clinics. Baldwin believes, however, that this reduction in morbidity is not very significant.

Passmore⁵⁴ believes that "the use of antiseptics have their place in the management of labor, but may be productive of much harm by giving the attendant a false sense of security." He is of opinion that patients are more safely treated by careful shaving and dry preparation. When a vulva pad is applied as in Bessesen's method, however, there would appear to be no disadvantage in using liquid antiseptics, since there is a very slight risk of washing contaminated material into the birth canal. This idea is supported by Chase,⁵⁵ who believes that, "The old method of sterilizing the delivery field by soap and water scrub just before delivery had always offered the chance of washing bacteria into the vagina, particularly in multiparae with gaping vulvar orifices. To avoid this and to give a better bactericidal effect, a modified Mercurochrome technic was adopted. In the four years following the change in technic, with an increasing number of deliveries each year, there were but fourteen cases of sepsis as compared with a yearly average of ten to fifteen in the previous years."

Henderson⁵⁶ reports that daily instillations of 1 per cent Mercurochrome solution aid in the healing of perineal lacerations. He reported his findings "with some little enthusiasm, and because of a certain added sense of security which this procedure gives to the mind of the obstetrician, especially in those more critical and difficult situations."

In an editorial in the *Journal of the American Medical Association*,⁵⁷ discussing this work, the statement is made that, "the care with which the experiment has been controlled gives significance to the result."

Later work by Emrich,⁵⁸ Schwarz,⁵⁹ Brown,⁶⁰ Danforth and Grier,⁶¹ Peck,⁶² Guttmacher and Douglas,⁶³ Gillaspie,⁶⁴ Greenhill,⁶⁵ Sellers and Sanders,⁶⁶ Sharp,⁶⁷ and Ware⁶⁸ confirms the findings already reported.

Chapter VI

MERCUROCHROME IN OPHTHALMOLOGY

AS EARLY as 1920 Clapp and Martin²¹ reported that the 2 per cent solution of Mercurochrome may be used with impunity in the treatment of ophthalmia neonatorum. They stated that it will not produce a permanent stain as occasionally happens with silver preparations and that the results were highly satisfactory.

Lancaster, Burnett and Gaus²² presented a combined laboratory and clinical report on the use of Mercurochrome in ophthalmology. The results in their cases also were good. One and 2 per cent solutions are ordinarily used.

Gradle⁶⁹ wrote very favorably of the use of Mercurochrome in various external infections of the eye, and stated that it "is probably the most valuable addition to the ophthalmic armamentarium of recent years." A further clinical report of the same nature was published by Ravdin.⁷⁰ Boeckmann²³ found that Mercurochrome is entirely satisfactory for ophthalmological purposes. These results have been confirmed by Weymann.²⁴ Results with other antiseptics were compared with those following the application of Mercurochrome. Bulson⁷¹ and Patton⁷² also use Mercurochrome in surgery of the eye.

In an article on first aid for the injured eye, Jones⁷³ advises the use of Mercurochrome in various conditions, while Rogers⁷⁴ recommends it after removal of foreign bodies.

Lewis M. Scott⁷⁵ has found that irrigations with Mercurochrome are valuable in the treatment of certain types of corneal ulcers. Yandell⁷⁶ also has found Mercurochrome to be efficacious in the treatment of this condition and in gonorrheal ophthalmia. Hughes⁷⁷ uses the solution to determine the extent of the damage in corneal ulcerations.

Iles⁷⁸ has reported that, "Mercurochrome is as efficient as silver nitrate in the prophylaxis of ophthalmia neonatorum. It is safer and is devoid of reaction. In the treatment of established conjunctivitis with Mercurochrome we see rapid subsidence of swelling and discharge. The necessity for frequent irrigation, and so for admission of the baby to the hospital, is avoided. The duration of treatment is reduced and the unaffected eye is protected." Iles uses from 1 to 5 per cent solutions.

Mayer⁷⁹ indicates that Mercurochrome is much more efficacious than some of the silver compounds and points out that there is no danger of argyrosis. Lazar⁸⁰ also recommends Mercurochrome in the treatment of gonorrheal infections of the eye.

Chambers,⁸¹ in a recent review of the subject, writes: "Few medical men seem to realize what a useful drug we have in Mercurochrome for certain ocular diseases. It is no new drug, having been used in Bristol (England) for the last four years, so that a vast number of cases have been treated with it. . . . In our hands in the treatment of certain eye diseases, it has proved to be a very powerful antiseptic, and the irritation caused by it in the majority of cases is negligible.

"For some time it has been my practice to paint these cases (conjunctivitis) directly they come to me and the results have been superior to those of any other type of treatment. We have found Mercurochrome superior to silver (silver com-

pounds) in that irritation is considerably less (therefore it can be applied at more frequent intervals), that it cannot damage the cornea, and that there is no danger of staining the conjunctiva even if the drug be used over a very long period.

"In the last four years the Bristol Royal Infirmary has issued a 1 per cent solution of Mercurochrome instead of the usual silver nitrate for instillation into the eyes of new-born babies. There has been a definite decrease in the case of ophthalmia neonatorum and now we never see those many red eyes that can be produced by silver nitrate.

"As a preliminary to all eye operations a 1 per cent solution of Mercurochrome is painted over the skin of eyelids and face after the part has been thoroughly cleansed in the usual way.

"With the experience of Mercurochrome over the period mentioned above, we feel justified in asserting that it is really of considerable value in ophthalmology."

Chapter VII

UROLOGY



SECTION I—URETHRITIS

MERCUROCHROME has proved to be of value in various infections of gonorrheal origin.

Young, White and Swartz¹¹ first reported the successful use of Mercurochrome in cases of urethritis in 1919. They found that in 1 per cent solution the drug may be retained in the urinary tract from one to three hours without irritation and, furthermore, that cases of long standing cleared up with surprising rapidity. Results were of a uniformly favorable nature.

In the following year Davis¹⁵ treated successfully sixty cases of gonorrheal urethritis in males with 2.5 per cent solutions. Satisfactory results were also achieved in the treatment of female patients.

Young, White and Swartz⁸² amplified their earlier report in 1921, and offered additional details regarding their method of treatment.

A note appeared in the United States Naval Medical Bulletin⁸³ for 1922 to the effect that, "The results obtained from the use of Mercurochrome in acute cases (urethritis) have been consistently better than the results obtained in similar cases with silver preparations."

Squires⁸⁴ also obtained very satisfactory results in cases of

gonorrheal urethritis in males, while Williamson,¹⁰ believes that, "Mercurochrome is probably the most generally useful of all preparations when the various pathology encountered in urology is broadly considered." Davis¹⁵ believes that, "Mercurochrome is of definite and proven value in the form of local instillations into the bladder and posterior urethra."

In a comparative study of cases treated with Mercurochrome and protargol, Chargin, Seckel and Stone⁸⁵ reported that, "Mercurochrome will prove of particular service in those cases where the silver salts for any reason are ineffective."

Pederson⁸⁶ published a study of Mercurochrome in clinical practice, giving careful details of the methods used. The results were, on the whole, satisfactory.

A series of articles on the value of Mercurochrome in gonorrheal infections was prepared by Brunet, Phelps, Bierman and Bentley.⁸⁷ The results with Mercurochrome were in general more satisfactory than those with other methods of treatment employed. Bierman reported that, "As a result of my use of Mercurochrome I have come to the conclusion that it is a very valuable addition to the group of drugs which we have for gonorrheal urethritis. In office use I have found it the most valuable drug of all," while Bentley states that, "Of the two series it would seem that the course of the disease was definitely shortened where Mercurochrome was used."

Walther⁸⁸ also comments favorably on the use of Mercurochrome in gonorrhea.

Nyberg¹³ found that Mercurochrome is very valuable in the treatment of gonorrhea of the lower genito-urinary tract in women, while Pemberton^{89,90} recommends it in urethritis in women. Barringer¹⁸ also obtained good results from the use of one-half per cent Mercurochrome for urethral instillation.

Jacoby,^{91, 92} in 1926, published a very favorable report on the treatment of gonorrhea in the female with Mercurochrome.

The solutions used in various treatments described vary in strength from one-half to 2 per cent. Occasionally somewhat more concentrated solutions have been used, but the results do not appear to be better than with the more dilute solutions. In some cases the solution is retained in the urethra for some time after instillation.

SECTION 2—CYSTITIS

Craig⁹³ reported that "Bladder instillation of Mercurochrome decreases the necessity for post-operative catheterization and *per se* decreases the probability of post-operative cystitis. It prevents the occurrence of bladder distention rather than the correction of a retention."

Weiner⁹⁴ recommends the instillation of Mercurochrome in the treatment of cystitis in prostatic cases.

After placing a small wick of gauze into the bladder, the dressings are saturated with 2 per cent solution of Mercurochrome and allowed to remain for at least four hours in suprapubic cystotomies. This technic is used by MacGowan.⁹⁵

SECTION 3—PROSTATITIS

Young, White and Swartz⁹⁶ obtained excellent results in the treatment of various genito-urinary infections, including acute and chronic urethritis, cystitis, pyelitis and venereal ulcerations. In most cases solutions varying from 0.5 to 1 per cent were used.

Young⁹⁷ later gave additional details regarding his method of treatment in a very complete paper on prostatectomy. Additional support of the results of Young have been published by Purcell.⁹⁸ Rosenkranz⁹⁹ also found Mercurochrome to be valuable in the preparation and treatment of cases of

prostatitis. Pomeroy,¹⁰⁰ in describing his method of stripping the seminal vesicles, states that, "The deep urethra is instilled with Mercurochrome as suggested by Young."

The complication of epididymitis in prostatectomies has been considerably reduced by Bryan¹⁰¹ by filling the bladder with Mercurochrome at the time of enucleation and instillation of Mercurochrome through the suprapubic wound into the bladder at intervals.

In a recent paper, Harris³⁹ reported excellent results in the prevention of infections in prostatectomy. The 2 per cent aqueous-alcohol-acetone solution is used for preparing patients and for injection into the bladder after it has been anesthetized. The aqueous solution is used in other cases.

Player,¹⁰² Graves,¹⁰³ Weiner⁹⁴ and Bannen¹⁰⁴ have also commented favorably on the use of Mercurochrome in prostatectomy cases.

SECTION 4—PYELITIS

A number of reports on the use of Mercurochrome in treating cases of pyelitis are available. Sexton¹⁰⁵ mentions that irrigation of the pelvis with 1 per cent solution of Mercurochrome has given good results.

Crosbie¹⁰⁶ used a 2½ per cent solution for pelvic lavage, while a 2 per cent solution is used for the same purpose by Wallace.¹⁰⁷ Klussman¹⁰⁸ has reported that the 1 per cent solution may be used successfully, but believes that it is necessary, as a precaution, to measure the pelvic capacity before introduction of the solution. In this way pains and kidney colic are often avoided.

The results of a bacteriological investigation carried out by Swartz and Davis²⁷ showed that Mercurochrome is a power-

ful germicide against the gonococcus. Clinical trials also proved that it is a useful agent in the treatment of gonorrhea. An additional laboratory investigation was reported by O'Connor,²⁶ who found that Mercurochrome was the most penetrating and least irritating antiseptic of the drugs studied in lavage of the renal pelvis. These laboratory findings provide a definite basis for the use of Mercurochrome in genito-urinary infections.

SECTION 5—OTHER INFECTIONS OF THE GENITO-URINARY TRACT

Ockerblad¹⁰⁹ has reported that cases of epididymitis may be successfully treated with 1 to 2 per cent solutions of Mercurochrome and that "the results are far superior to those obtained by any other substance . . . tried." A number of patients with chronic vesiculitis were also successfully treated.

Squires⁸⁴ found that urethral injections of Mercurochrome give good results in gonorrhea in young males, while Stone¹¹⁰ published a very favorable report on the use of Mercurochrome in acute gonorrheal epididymitis. The results with this form of treatment were compared with those following various other methods.

In an article on the modern treatment of gonorrhea, Walther¹¹¹ comments favorably on the value of Mercurochrome in the care of various urinary infections.

Wesson¹¹² believes that, "5 per cent Mercurochrome is the most satisfactory drug to use (in the treatment of traumatic hydrocele) as it is painless, not causing epididymitis, and the result is apparently either an immediate cure or frank failure."

Chapter VIII

INFECTIONS OF THE LOWER GENITO-URINARY TRACT IN WOMEN



SECTION I—GENERAL

IN THE treatment of gonorrhea in the female, Nyberg¹⁸ first cleanses thoroughly the muco surfaces of the external genitalia and applies a 5 per cent solution of Mercurochrome. The urethra is then irrigated with 2 per cent solution of Mercurochrome and a small quantity is passed into the bladder. In cases of cervicitis the cervix is thoroughly cleansed and a 5 per cent solution of Mercurochrome is applied. Nyberg states that, "Mercurochrome is an exceptionally good antiseptic in treating gonorrhea in women." Cotton tampons saturated with 2 per cent solution may be inserted into the vault of the vagina in these cases.

Davis¹¹³ reports that, "Mercurochrome in 3 to 5 per cent solutions has been found a very useful germicide for the treatment of acute and subacute conditions and as an adjunct to the cautery in chronic endocervicitis. It is used by us in the preparation for vaginal operations."

DiPalma,¹¹⁴ describing a new instrument for the treatment of endocervicitis, writes that the 2 per cent solution of Mercurochrome used as a medication has given good results. He believes, however, that medication is of value chiefly in the milder types of cases.

In an extensive report on his experience in the treatment of gonorrheal endocervicitis, Brady⁷ reports that, "A 20 per cent solution of Mercurochrome has been used and our experience has shown that, for the endocervix, this drug is absolutely safe in this strength. Less local reaction followed the use of Mercurochrome than after the other two drugs." He reported excellent results following the use of this method.

Twenty per cent solutions of Mercurochrome are also used by Black,¹¹⁵ who introduces the solution into the endocervix by means of an applicator. The patient is treated weekly for three or four weeks. A small piece of cotton, saturated with a 20 per cent solution, is pushed into the endocervix.

Dallas¹¹⁶ recommends the use of 10 to 20 per cent Mercurochrome in a mixture of equal parts of glycerine and ichthymol in cases of non-gonorrheal endocervicitis and vaginitis. The ointment is instilled into the vagina by means of a syringe and held in contact with the cervix with a lamb's wool tampon.

Rowlett¹¹⁷ reported that he had "obtained excellent results in the gonorrheal cases by following Kelly's technic which consists of a bi-weekly use of a 20 per cent Mercurochrome solution in the cervical canal as high as the internal os." In addition, he prescribes hot daily vaginal douches with some good antiseptic solution. He keeps this up until three or four negative smears for the gonococcus have been obtained.

Dabney¹¹⁸ has also found Mercurochrome to be useful in gonorrheal infections in women, while Poska⁸ employs the finely powdered solid in the treatment of cervical gonorrhea. He reported that, "In an extensive use of this method, covering a period of several years, it has not in a single instance produced any untoward effect."

Blair's¹¹⁹ technic consists of careful cleansing of the cervix,

cul-de-sac and vaginal walls, and a thorough application of 2 per cent solution of Mercurochrome to the cervix and vagina until the entire vaginal wall has been painted. A similar solution is placed well up in the cervical canal by means of a cotton applicator and allowed to remain for two minutes. This is followed by an application of a dehydrating powder.

Dannreuther¹²⁰ packs the cervical canal with a strip of gauze soaked in 2 per cent solution of Mercurochrome. "A few drops of Mercurochrome solution are also injected directly into the structure of the portio with a dental hypodermic syringe."

Walther¹²¹ also uses Mercurochrome in various gonorrheal infections in women, while Matthews¹²² recommends the use of 4 to 10 per cent Mercurochrome in the treatment of endocervitis.

Powell¹²³ reports that Mercurochrome in 5 per cent solution is very useful in the treatment of chronic endocervicitis. The solution is used at weekly intervals until healing is complete.

Davis¹²⁴ believes that "5 per cent solution has advantages . . . as an antiseptic in the treatment of various forms of vaginitis."

Gordon¹²⁵ has found that "Packing the cervical canal and vaginal vault with narrow strip gauze, saturated with 5 to 10 per cent Mercurochrome in 50 per cent alcohol, will often give good results in cases of acute endocervicitis."

In treating lesions of the cervix, Glass¹²⁶ recommends cautery and the use of a tampon, soaked with 4 per cent Mercurochrome, placed flush against the cervix. "The tampon is left in the cervix at least twelve hours, serving two purposes, *i.e.*, as an antiseptic, and to aid hemostasis if the cauterization has been inadequate."

Dannreuther¹²⁷ later refers again to the value of Mercurochrome in applications to the vagina and to the cervix.

Bryant,¹²⁸ in an article dealing with newer methods in the treatment of Neisserian infection of the female, states that after use of the cautery, "The cervix is now packed wide open with gauze dressing saturated with 10 per cent solution. This initial dressing is not disturbed for seventy-two hours. Thereafter it is changed and the parts irrigated with some hot antiseptic every second day."

Wood¹²⁹ reports that in repairing lacerations of the cervix, "It is my custom to instill about two drams of 4 per cent solution of Mercurochrome before the repair is attempted, as well as when all repairs are completed. I also have two drams of the solution instilled into the vagina night and morning for about a week following delivery."

Leff¹³⁰ recommends the treatment suggested by Bandler, "Clean the vagina and portio. Paint them with 4 per cent Mercurochrome solution. Remove, with the aid of a suction-tube, as much of the inflammatory material from the canal as you can. Paint again the portio with Mercurochrome solution. Pack it with gauze strips (2-inch bandage makes a good packing material). Remove the packing in twenty-four hours and repeat the process until the acute stage is gone."

Condit¹³¹ uses the following technic for infants. "Treat an infant suffering from acute vaginal infection by injecting 3 per cent Mercurochrome in melted lanoline through a catheter into the vagina with an air blast. The wall is then swabbed with 10 per cent Mercurochrome solution and packed with wool tampons saturated with equal parts of glycerine and ichthyolidin."

Lash¹³² has also found various strengths of Mercurochrome valuable in the treatment of infections of the female generative tract.

In describing his technic of primary cervical repair, Emrich⁵⁸ states that, "The pubic region, thighs, buttocks and anal area are painted with 2 to 4 per cent Mercurochrome solutions. Mercurochrome solution is introduced into the vaginal tract with a bulb syringe or a swab is used."

The use of Mercurochrome solutions in various infections of the female generative tract has also been mentioned by Burch,¹³³ Morgan,¹³⁴ Sprague,¹³⁵ Offutt,¹³⁶ Walke,¹³⁷ Lancaster,¹³⁸ and Ende.¹³⁹

SECTION 2—VULVOVAGINITIS

Stein,¹⁴⁰ in 1923, described the use of a 1 per cent Mercurochrome ointment in the treatment of vulvovaginitis. The ointment is made up in a base containing equal parts of lanoline and white vaseline. It is reported that the average course of the treated cases was seven weeks, or less than one-half of the usual duration. This method of treatment was described in greater detail and a further series of cases was reported in the following year by Dorne and Stein,¹⁴¹ who concluded that, "Vulvovaginitis can be cured by daily injections of 1 per cent Mercurochrome ointment into the vagina."

Lynch¹⁴² has indicated the advantages of incorporating 2 per cent Mercurochrome in a suppository base in young virgins.

Stein, Leventhal and Sered¹⁴³ published a further favorable report on the use of Mercurochrome ointment in 1929. Their report dealt with 296 cases.

Miller¹⁴⁴ uses 10 per cent solutions of Mercurochrome in sterile jelly and states that this method of treatment has given good results. The use of a 2 per cent aqueous solution of Mercurochrome in the treatment of senile vulvitis and vulvovaginitis is recommended by LeDoux.¹⁴⁵

SECTION 3—TRICHOMONAS VAGINITIS

The first report on the use of Mercurochrome in the treatment of trichomonas infections of the vagina was that of Davis and Colwell¹⁴⁶ in 1929. It is recommended that, "whenever the vaginal mucosa is inflamed, it is painted with a 5 per cent solution of Mercurochrome."

Visher¹⁴⁷ later reported the use of Mercurochrome in vesical infection with trichomonas vaginalis. "The kidney was lavaged with 0.5 per cent Mercurochrome solution twice daily for the next two days. Bladder irrigations with boric acid solution followed by instillation of one-half ounce (15 c.c.) Mercurochrome solution were given every day for a few days, resulting in prompt improvement in the bladder symptoms and decrease in the number of flagellates in the urine." The author remarks that, "The therapeutic response to pelvic and vesical lavage was certainly striking."

Cornell, Goodwin and Matthies¹⁴⁸ recommend the use of "Lassar's paste on wool tampons in the vagina which has been washed out with soap and water and Mercurochrome."

It is recommended in the City of New York Department of Health Weekly Bulletin, December, 1928,¹⁴⁹ that 2 per cent solution of Mercurochrome should be instilled daily into the vagina in cases of gonorrheal vaginitis in children. It was found that the addition of 8 per cent gelatin to the 2 per cent Mercurochrome solution gives striking results in many cases. "Other types of simple antiseptic have been tried, but we believe that Mercurochrome gives the best results."

Chapter IX

OTHER USES



SECTION I—OTITIS MEDIA

CALLISON¹⁵⁰ has found that Mercurochrome in alcoholic solution gives good results in the treatment of chronic otitis media, while solutions in water, glycerine and alcohol have proved satisfactory in the chronic suppurative type according to Mulsow.¹⁵¹ Four and 5 per cent solutions in 50 per cent alcohol have been used successfully by McAuliffe,^{152,153} Wagers¹⁵⁴ has treated cases of chronic otorrhea with a similar solution and states that, "From the standpoint of recurrence, the results obtained from the use of Mercurochrome appeared to be most lasting." Wherry¹⁵⁵ also has found this solution to be beneficial.

Cowley¹⁵⁶ developed a technic for otitis media cases using first hydrogen peroxide, then ether, and finally 4 per cent Mercurochrome. He found this treatment more effective than any previously used. Gable¹⁵⁷ uses a wick saturated with 2 per cent Mercurochrome solution in the treatment of otomycosis, while Ingram¹⁵⁸ reported good results in otic mold infections.

SECTION 2—EMPHYEMA

Bray⁹ has reported the use of instillations into the pleural cavity of Mercurochrome solutions varying in strength from 1:250 to 1:5,000 over a period of two weeks, following inter-

costal incision and drainage of the accumulated pus in a mixed streptococcus and pneumococcus infection. He believes that marked improvement resulted. No ill effects were noted.

SECTION 3—FUNGUS INFECTION OF THE SKIN

White,³⁸ in 1927, published a review of fungus diseases of the skin and of various agents used in treatment. He has used Mercurochrome "in almost all forms of epidermophytosis, and I no longer dread the appearance of a new patient or the reappearance of an old patient. I have confidence enough to say that in my own use of Mercurochrome, I have found a drug superior to any I have tried in this most refractory disease."

Coplan and Litterer¹⁵⁹ comment on the value of Mercurochrome in blastomyces dermatitis, and Wise¹⁶⁰ advocates its use in preventing recurrences of ringworm infections of the feet and hands. Blaisdell¹⁶¹ has also reported favorably. The 2 per cent aqueous solution is usually applied daily in these cases.

Hazen¹⁶² has found that of the agents used in the treatment of eczematoid ringworm Mercurochrome in solution or ointment and Whitfield's ointment are of most value.

Clinical evidence is supported by a certain amount of laboratory data. Detwiler and McKennon¹⁶³ report that, "Mercurochrome in concentrations ranging from 1:500,000 to 1:1,000,000 has been employed successfully as a fungicidal agent in the growth of *Amblyostoma* embryos. Molds growing on the larvae usually slough off within two days when in the presence of Mercurochrome (concentration 1:750,000)." Stearn and Stearn,^{164,165} found that Mercurochrome inhibited growth of various fungi associated with infections in dilutions ranging from 1:5,000 to 1:160,000.

Chapter X

THE INTRAVENOUS USE OF MERCUROCHROME

THERE have been many articles relating to the intravenous administration of Mercurochrome. During the early stages of this therapy comparatively large doses of the drug were used, and a number of serious reactions were reported. It has now been shown, however, that results are obtained when much smaller doses are given and that the reactions from small doses are usually not serious.

Furthermore, Redewill and Potter¹⁶⁶ have found that the use of glucose with Mercurochrome reduces the reaction very markedly. This has been confirmed by Macht and Harden.³ Glucose-Mercurochrome solutions must, however, be freshly prepared, since glucose precipitates Mercurochrome from solution after a short time.

Some individuals appear to exhibit an idiosyncrasy for Mercurochrome and the reaction is severe. Symptoms at times are temporarily of a somewhat alarming nature. In such cases, a rapid and considerable rise in temperature has been noted, accompanied by signs of decided gastric irritation, frequent loose and occasional bloody stools, and irregularity in urinalysis. It has been found that in such cases there is a temporary kidney dysfunction owing to a certain amount of damage to this organ. Apparently, in such cases also, more Mercurochrome is eliminated by the liver than in cases where the reaction is

not so marked. In most instances, however, where the initial dose has been moderate, there is a rapid subsidence of these symptoms followed in some cases by immediate improvement in the general condition of the patient. It has been suggested that in view of the idiosyncrasy for Mercurochrome exhibited by some subjects, the initial dose should in every case be small. The reaction of each patient may thus be determined before larger doses are given. Young, Colston and Hill¹⁶⁷ believe that Mercurochrome produces a protective reaction which plays an important part in combating blood stream infections, while Hill and Colston¹⁶⁸ later advocated the clinical trial of intravenous Mercurochrome in cases of *B. coli* infection of the urinary tract.

A report giving an indication of the effect of the intravenous use of Mercurochrome was published by Piper¹⁶⁹ (1922), who found that when five milligrams per kilogram of a 1 per cent solution were injected into rabbits, no change was noted in the red cell count, only slight variations occurred in the white cell count, while the differential count remained the same. There was no haemolysis nor marked urinary changes and no lesions were found in any organ.

Young and Hill¹⁷⁰ still later reported that Mercurochrome had prevented fatal endings in a number of cases of septicemia. Guy,¹⁷¹ in 1924, pointed out that Mercurochrome is not entirely innocuous and described a case of stomatitis following the injection of Mercurochrome in tubercular sinus. Visser,¹⁷² on the other hand, reported that he had obtained no untoward reactions. In the same year a staff report on the use of Mercurochrome was prepared by Hench, Morse, Magath, and Braasch¹⁷³ at the Mayo Clinic. It was reported that the intravenous administration of Mercurochrome had given satisfactory results in some cases. Adams¹⁷⁴ also stated

that he had given as much as six milligrams per kilogram with safety, while Hill and Bidgood,¹⁷⁵ in a report in the Johns Hopkins Hospital Bulletin, stated that there was a mild reaction in the kidney, which was proportional to the dose given. Their results were obtained with animals. Piper,^{176,177} in 1925, published the results of further work with intravenous Mercurochrome and considered that the method of treatment gave marked success. Noble¹⁷⁸ found no abnormality in urinalysis in a patient who was treated in this way for streptococcus septicemia, while Simpson¹⁷⁹ found that it was an exception for febrile manifestations to appear after injection. Avison and Koo¹⁸⁰ reported that one patient, who was intolerant of quinine, readily tolerated injections of Mercurochrome. Young, Hill and Scott,¹⁸¹ in 1925, stated that there were no injuries in the kidneys, intestines or other organs following the use of Mercurochrome in moderate amounts, while Redewill and Potter¹⁸² found that patients showing hypersensitiveness for intravenous Mercurochrome secrete a proportionately greater amount in the saliva and gastro-intestinal tract than by way of the kidneys. Horsley¹⁸² observed a transient albuminuria, nausea, vomiting and moderate diarrhea, following injections of Mercurochrome. There were no other untoward effects. In 1926, Young¹⁸³ discussed 680 clinical cases which had been treated with intravenous Mercurochrome and concluded from his experience that it is of great value. He recommended, in 1927,¹⁸⁴ that chronic and subacute infections should receive an initial injection of two or three milligrams per kilogram. In fulminating cases, an initial dose of five milligrams per kilogram was advised. He stated that the injection caused no irritation to the kidneys and only transitory intestinal irritation which, in the majority of cases, was highly efficacious. Wil-

liams and Small,¹⁸⁵ in a summary of seventy cases of gonococcus infection treated with Mercurochrome intravenously, believe that the treatment is of great value in such conditions, that it is not dangerous, that reactions are rare, and that renal and intestinal irritation is absent. Mercurochrome has been used intravenously even in children. Zeligs¹⁸⁶ reported a case of acute typhoid cholecystitis, which was cured by the intravenous administration of Mercurochrome. On the other hand, Roddy¹⁸⁷ stated that the severe reaction which occurs in some cases should restrict the use of Mercurochrome to selected patients. Hagan¹⁸⁸ believes that the intravenous use of Mercurochrome should be considered a dangerous procedure which is, however, justified and that it seems to be of definite value in septicemia.

There are numerous reports, throughout the various clinical journals, dealing with many hundreds of cases which have received intravenous treatment with Mercurochrome and it must be concluded that this method is of value in certain cases. It is obvious, however, that some patients show a marked hypersensitiveness or idiosyncrasy for Mercurochrome and it would seem advisable that in most cases the initial dose should not exceed two or three milligrams per kilogram, since there are undoubtedly some individuals for whom such treatment is contra-indicated.

A 0.5 per cent solution should be used for intravenous injection.

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