

JOHANN FRIEDRICH AUGUST VON ESMARCH: HIS LIFE AND CONTRIBUTIONS TO ORTHOPAEDIC SURGERY

John E. Herzenberg, M.D., F.R.C.S.(C)
Instructor in Orthopaedic Surgery
University of Michigan Hospital
Ann Arbor, Michigan 48109-0328

INTRODUCTION

Orthopaedic surgeons make daily use of the Esmarch rubber bandage to create a bloodless field of surgery, enabling completion of complex extremity surgery. However, the rubber tourniquet which bears the eponym of Esmarch is but one of many contributions made by this man who was one of the most innovative and respected surgeons of his day. His remarkable personal life and professional accomplishments which served as an inspiration to his students at the University Kiel can equally inspire the modern day orthopaedic surgeon.

BIOGRAPHY

Johann Friedrich August von Esmarch (Fig. 1) was one of the last great surgeons of the nineteenth century German school. He was primarily a military surgeon and has been therefore called the "Ambroise Pare of Germany", after the sixteenth century French military surgeon. Born on January 9, 1823, in the small town of Tønning, on the west coast of Schleswig-Holstein, he was the son of a district surgeon. As a nine-year-old schoolboy, he dissected frogs, and accompanied his father on his rounds. His schooling was in Redsburg and Flensburg, though he was less than a model student. Esmarch was a proud German patriot, and participated in the struggle to free his native Schleswig-Holstein from Danish control.

He studied medicine at the University of Kiel and Göttingen and received his medical degree from Kiel in 1848, passing the state examination with the highest grade. Esmarch graduated medical school during the era in which ether and chloroform were introduced into Germany, making surgery a vastly more attractive specialty for the young Esmarch. Upon graduation, Esmarch began working as an assistant to the great Professor Bernhard von Langenbeck. Langenbeck was recognized as the greatest surgeon of his time, and profoundly influenced Esmarch (Langenbeck later left Kiel for Berlin and founded the German Society of Surgery, the *Archiv für klinische Chirurgie*, and trained most of the famous German surgeons of the nineteenth century).

Immediately following his graduation from medical school, war broke out between Denmark and Germany, and Esmarch began his career as military surgeon. In the initial

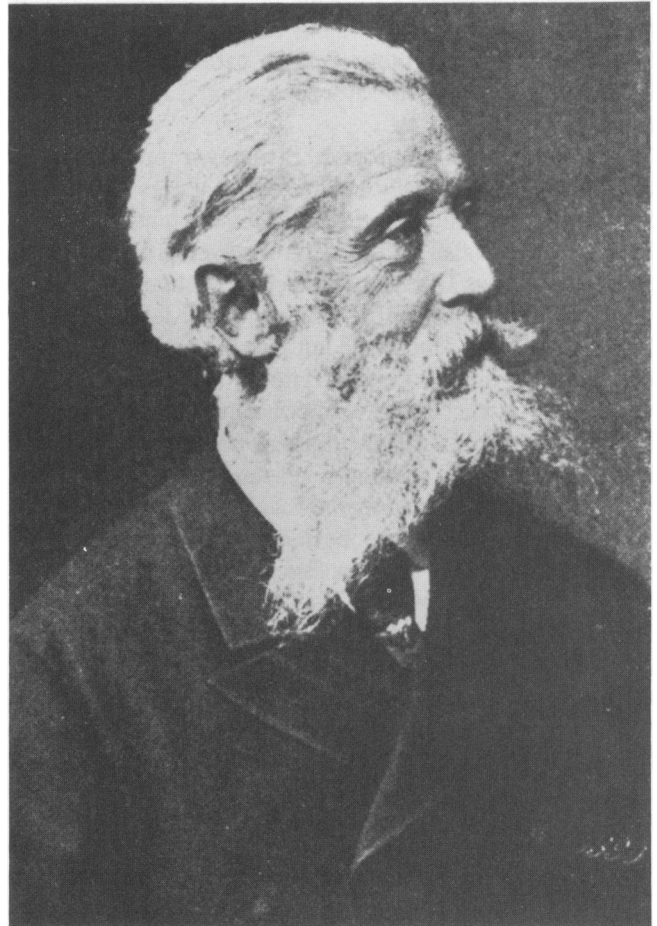


Fig. 1

Friedrich von Esmarch (from the *British Medical Journal* 1:719, 1908).

battles, he was a line officer (lieutenant), having joined with other young German patriots in secret arms training prior to the outbreak of hostilities. His talents, however, lay in his ability to provide expert and compassionate care for his wounded comrades. During the battle of Bau, while trying to control a severed brachial artery in a fellow German soldier, Esmarch was captured by the Danes. He was held on the prison ship "Droning Maria" for nine

weeks, until he was exchanged for a Danish doctor. During the wars of 1848 and 1850, he worked alongside Professors von Langenbeck and Stromeyer in the field hospital at Flensburg, his boyhood home. After the cease fire of Malmo, he set up a private practice in Kiel. Soon thereafter, he left on a study tour of the great European medical centers; Prague, Vienna, Paris, Brussels and London. Upon his return to the University of Kiel, Esmarch was appointed privat dozent (equivalent to associate professor).

Working alongside Esmarch in the struggle for independence from Denmark was Professor George Stromeyer, who succeeded Langenbeck as Chief of the Surgery at Kiel when Langenbeck was called to Berlin. Stromeyer was also a great military surgeon, but is most remembered for popularizing the operation of subcutaneous tenotomy. One of Stromeyer's more famous patients was William Little of England, who later described Littles' disease (cerebral palsy).

Esmarch's association with Stromeyer proved to be beneficial both personally and professionally, as he married Stromeyer's daughter in 1854. When Stromeyer left to become General staff doctor of the Hanover Army, Esmarch succeeded him as Director of the clinic. Although Esmarch was Chief of Surgery at the University of Kiel, the Danish Minister of Education would not give Esmarch the title of full Professor until three years later in 1857. Although this wait had to be frustrating for him, he spoke of it in typically lighthearted terms. When told that he was too young to be a full Professor, Esmarch responded by saying "that was a well known fault that would disappear with every year." Esmarch held the position of Director until his retirement in 1899. His marriage was a happy one, until his wife's death on May 30, 1870 after a severe, chronic illness. Their son Edwin von Esmarch, a bacteriologist, later became Professor of Hygiene at the University of Gottingen, 1899.

During the turbulent period from 1866 to 1870, war broke out again, and Germany fought first against Denmark, then Austria, and France. Esmarch served an important role in the Franco-Prussian war as consulting surgeon and public health officer supervising the military hospitals near Berlin (Fig. 2). In the later years of the campaigns, Esmarch was unable to serve in the field, as he was recovering from an illness he contracted while operating. In 1871, at age 48, he became Surgeon General of the German army. In 1872 he married his second wife, the Princess Henriett von Schleswig-Holstein-Sonderburg-Augustenburg, who was an aunt to the German Emperor William II. She had been a friend to Esmarch, but it was unusual in those days for a member of the royalty to marry a University professor. Henriett bore Esmarch at least one son, in addition to the two children from his previous wife. It was Emperor William who titled von Esmarch "Excellency" in 1899, when at the age of seventy-

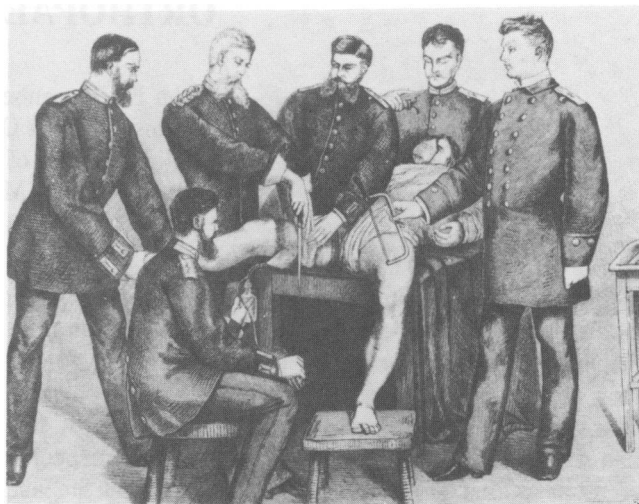


Fig. 2

Esmarch amputating a soldier's leg. Note the thigh tourniquet and the use of carbolic spray antiseptics. (From the Surgeon's Handbook on the Treatment of Wounded in War, 1878.)

six he retired from active practice. Nine years later, on February 23, 1908, he died of pneumonia following influenza. Even before his death, a statue was erected in his hometown Tønning to commemorate him.

Esmarch's household, across from the hospital, was graceful and comfortable, but not ostentatious, despite his marriage to royalty. His wife adroitly juggled her dual roles as royalty and dutiful housewife to the University professor. It was said that Esmarch was a great sportsman, mountaineer, and hunter with numerous trophies to his credit. His voice was low, and he spoke in short sentences. While not excelling as a public speaker, Esmarch was a spirited story teller in the company of small groups, both at home and at work.

Despite its small size and out of the way location by the Baltic coast, Esmarch built up the Kiel surgery clinic and attracted patients and students from far away. Esmarch was described as technically talented and very practical minded. His surgery was fast, confident, yet careful. In forty years of practice, Esmarch performed over twenty-thousand major operations. In addition to his technical prowess, he was recognized as an unusually insightful diagnostician. He was particularly adept at recognizing the orthopaedic manifestations of psychiatric illness such as hysteria and neurosis. Esmarch was loved by his patients, and had a gentle way with small children. Even patients with terminal illness found comfort in his kind manner.

Esmarch taught his students by demonstration rather than lecture, and trained them to be practical, effective physicians rather than helpless theorists. He maintained an extensive collection of pathological teaching material,

and spared no expense to have artists draw pictures of unusual cases. His monograph on elephantiasis was particularly well illustrated.

CONTRIBUTIONS

Esmarch was a prolific writer, publishing a large number of monographs dealing with military and trauma surgery. He was an early convert to Lister's antiseptic technique, after having visited England and Scotland. At the 1881 Seventh International Medical Conference, Esmarch spoke against the overly aggressive surgical approach to war wounds, despite the advances made in antiseptics. Esmarch felt that Lister's techniques reduced morbidity and mortality for elective civilian surgery, but not for battlefield surgery. It was around this time that the importance of wound debridement was being rediscovered by the Russian military surgeon Carl Reyher in the Russ-Turkish war. Ultimately, it was wound debridement and not antiseptics that proved to be the most critical factor in reducing mortality from war wounds to the extremities.

Esmarch urged against an overly invasive approach to gunshot wounds. He reviewed the medical treatments rendered to the U.S. President James Garfield after an assassination attempt. Esmarch concluded that the bullet, which shattered the twelfth thoracic vertebra, but did no damage to the spinal cord, should have been left alone. He wrote that the numerous wound probings by fingers, catheters, and instruments caused the abscess which eventually eroded the President's splenic artery and caused his demise eleven weeks after the original wounding.

During the Franco-Prussian war, Esmarch worked with the great pathologist Rudolf Virchow to further develop the battlefield hospital pavilion system, first initiated by the Americans in the Civil War. Esmarch pioneered the treatment of gunshot wounds to the extremities by conservative local resection of damaged parts, in contrast to the common practice of radical amputation of the entire limb. In 1851, following his experience in the Danish war, he published a treatise on "Resection of Bullet Wounds." In it, he described conservative resection of the injured part, as opposed to amputation of the entire limb. Esmarch was not, however, dogmatic in this approach, and he recognized the relatively good results obtained from amputation surgery.

Esmarch displayed deep concern for wounded soldiers, and became an innovator in battlefield first aid. His sense of humanity was revolted by the horrors of war, and he wrote a treatise "Against the Terror of War." In his typically pragmatic fashion, he channeled his concern for the misery and suffering of the wounded into efforts to teach lay people to render appropriate immediate first aid. He was particularly interested in preventing needless death from exsanguination before the physician arrives (Fig. 3).



FIG. 414. APPLYING A TOURNIQUET SUSPENDER

Fig. 3

Immediate first aid to the wounded -- a lifelong concern of Esmarch. (From *Surgical Technic*, 1901.)

As Surgeon-General, Esmarch required every German soldier to have an "Antiseptic Dressing Package". This is described in the German Military Sanitary Regulations of 1886 as containing, "two antiseptic muslin compresses 40 cm. X 20 cm., a cambric bandage 300 cm. X 5 cm., a safety pin, and waterproof material 28 cm. X 18 cm., for covering."

Esmarch also developed his "von Esmarch triangular cloth bandage", not to be confused with the Esmarch tourniquet bandage. This three-cornered bandage had detailed illustrations of wounded soldiers printed on the cloth itself (Fig. 4). The illustrations depicted its appropriate use on any part of the body, so that the soldier could properly apply the bandage according to the illustration. Some of the non-medical military authorities objected to distributing this graphic display of battlefield horrors to the soldiers, but Esmarch prevailed. A later modification of the arm issue first-aid package included Esmarch's triangular bandage, along with its pictures of six naked wounded soldiers, each with an Esmarch triangular bandage binding a different part of the anatomy (Fig. 5).

Esmarch published a pamphlet titled "First Dressings on the Battlefield" (1869) and later adapted his work to civilian life when he published a layman's handbook of "Early Aid in Injuries and Accidents" (1875). This was translated into English in 1883 by HRH Princess Christian and published in America. It was considered at the time to be a classic work, and was translated into twenty-three languages. In this pamphlet Esmarch explained his philosophy of first aid:

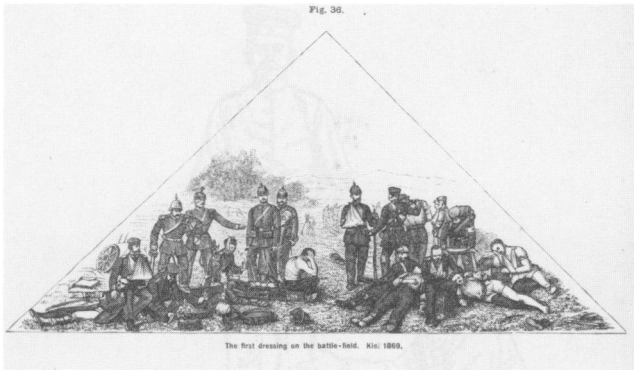


Fig. 4

Esmarch's triangular bandage for soldiers' first aid kits. (From Surgeon's Handbook on the Treatment of Wounded in War, 1878.)

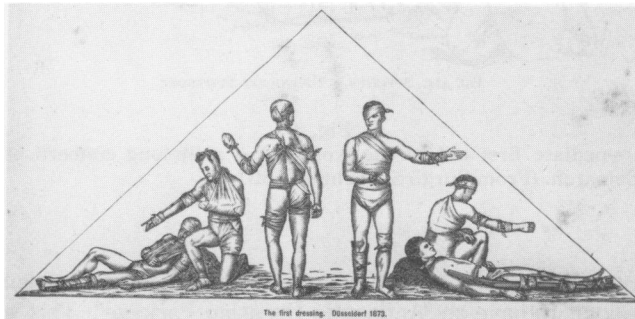


Fig. 5

Revised printing of Esmarch's triangular bandage; felt by the German military authorities to be less demoralizing than the previous version with the battlefield scene. (From Surgeon's Handbook on the Treatment of Wounded in War, 1878.)

“Though I have invited you here to teach you how to render first aid to the injured, I do not in the least aim at rendering a doctor's services unnecessary; on the contrary, I hope to convince you how important the immediate help of a doctor is in most cases. What I want to do is enable you to give the right kind of aid before the doctor arrives—without which, irreparable damage might be done, and perhaps even a valuable life be lost”.

“When I look back at my career as a surgeon, I can with truth say that many and many are the times I have deplored that so very few people know how to render the first aid to those who have suddenly met with some injury . . . of the thousands who have flocked thither in their desire to help, so few have understood how to render aid.”

“How many there are every year who die a miserable death, and who might have been saved by prompt aid, had anyone been near who knew how to give it.”

Esmarch further devoted his energies to the founding of the Samaritan Movement in which first aid was taught to civilians from all walks of life. He was inspired by the

order of St. John Ambulance Association which he had observed in London. On returning home, Esmarch gave some simple emergency medical lectures to the laymen of Kiel, and was overwhelmed by the enthusiastic response. There was some resistance from Esmarch's medical colleagues who feared that the laymen trained in first aid would be dabbling in medicine. Esmarch persisted however, and eventually there was a Samaritan School in virtually every village in Germany. Appropriately, they used Esmarch's “Textbook for Samaritans” as training material. This tradition is being continued in modern times in the form of the ever popular cardiopulmonary resuscitation courses.

Esmarch was particularly interested in teaching laymen how to control bleeding to prevent death from exsanguination. In addition to describing the various points where finger pressure would control a named artery, Esmarch advocated the use of tourniquets to control extremity bleeding. To this end, he advised every male citizen to wear specially designed suspenders that could be quickly removed and used as a tourniquet in the field.

Esmarch is most well remembered for his description of the “bloodless technique of surgery” employing the tourniquet that bears his name. He first presented his method to the Congress of the German Surgical Association in 1873. Esmarch very humbly and humourously related that hardly any of his colleagues at the Congress paid any attention to his paper, at least in partly due to the fact that Esmarch's paper was positioned on the program just before dinner. Within a year, however, his method was standard operating procedure throughout the hospitals of Europe. He published “The Art of the Bloodless Operation” (1873), and later devoted an entire chapter in his textbook “Surgical Technic” to the history and varieties of tourniquet control. This textbook was Esmarch's magnum opus, and for it he received a prize from the Empress August. In the second edition, it was expanded to three volumes and translated into several languages, including English.

The original Esmarch bandage was an elastic band 5 X 140 cm. made of pure India rubber which was wound around the limb from distal to proximal, overlapping one-half of each turn (Fig. 6). Esmarch noted that it is unnecessary to wrap toes and fingers individually. He makes the important point that local infection or malignancy are contraindications for the elastic bandage, proposing an alternative:

“Such parts as contain pus, sanious matter or soft tumor tissue, must not be bandaged, because thereby infectious matter might be pressed into the cellular tissue and the lymph channels. In such cases, the operator must be satisfied to hold the limb up perpendicularly for a few minutes until it has become visibly pale.”

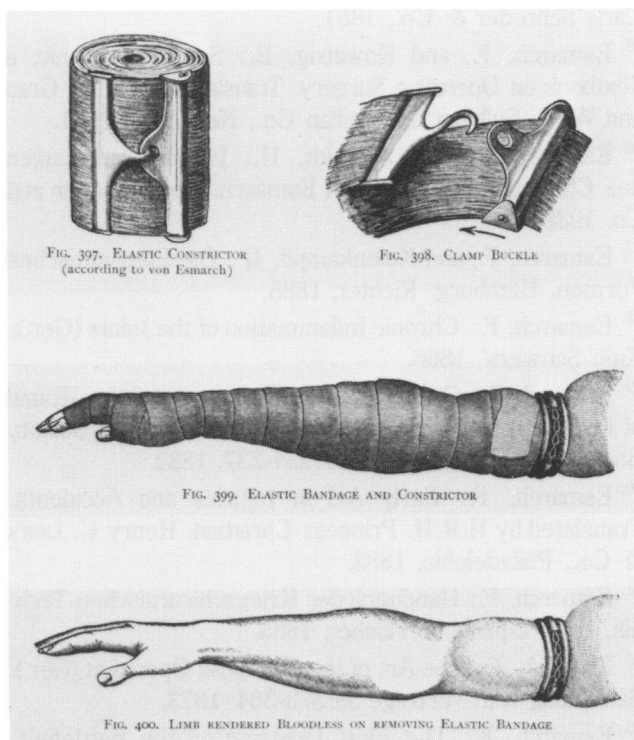


Fig. 6

Esmarch's elastic bandage for exsanguination; demonstrated on the upper extremity with a brass chain tourniquet. (From Surgical Technic, 1901.)

Interestingly, one of Esmarch's early case descriptions was the use of the exsanguinating bandage for a "necrotomy" for bilateral chronic osteomyelitis. Once rendered bloodless, a constrictor band was placed as high up as possible to prevent blood from re-entering the extremity. Esmarch used a variety of different constrictors, but today a manometrically controlled blood pressure cuff is most frequently used. Esmarch advised that the constrictor could be left on for "several hours" safely, and even sites cases where the extremity was bloodless for "seven to twelve hours without resulting in gangrene or paralysis."

Esmarch recognized the well known phenomena of secondary hyperemia that follows removal of the constricting band, and proposed a remedy:

"When the constriction bandage is removed at the end of the operation, the limb, which until then presented a deadly pallor, turns as red as a boiled lobster, and a very considerable hemorrhage occurs in the wound, because the walls of the blood vessels were in a state of paresis and had become flaccid from the continued pressure upon the vasomotor nerves; hence, they allow more blood to pass through them than in their normal condition. The consequence is that the blood gushes forth from the operating wound as from a sponge. The hemorrhage is,

of course, most violent if the constrictor is removed slowly, because the blood immediately enters the arteries . . . but since it cannot return immediately through the veins, which are still compressed by the last turns of the bandage, venous congestion is likely to occur. Hence, it is necessary to remove the constrictor not slowly, but quickly".

Esmarch recommended that his bloodless technique be used for operations of the extremities, and even of the penis (Fig. 7). Although not in usage by modern day urologist, the technique of bloodless surgery has proved absolutely essential for extremity surgery.

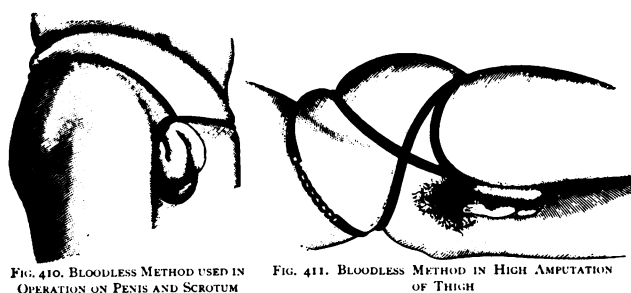


Fig. 7

Esmarch's bloodless technique for urologic surgery and thigh surgery. (From Surgical Technic, 1901.)

Esmarch had a variety of other contributions, including a treatise on chronic inflammation of the joints, on illnesses of the rectum and anus, on elephantiasis, on orthopaedic manifestations of neuroses, on the circulation of air within human dwellings, and the care of scrofulous children. He was an innovator, designed a face mask for ether administration, and numerous traction-splint devices (Fig. 8).

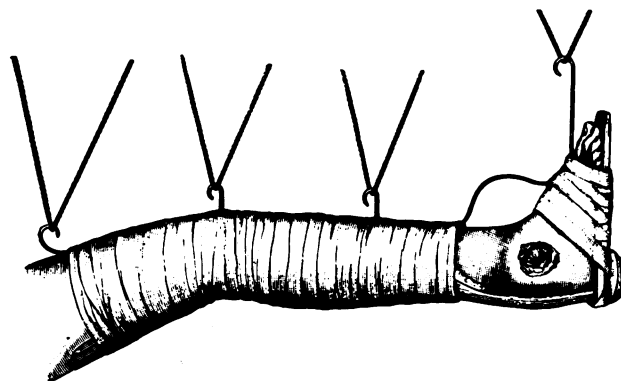


Fig. 8

One of the numerous traction-splinting devices that Esmarch invented. (From Surgical Technic, 1901.)

He was the first to describe intracranial epidermoid tumors, and was a pioneer in the use of cryotherapy (Fig. 9).



FIG. 63. ESMARCH'S COLD COIL

Fig. 9

Esmarch's Cold Coil for anti-phlogistic treatment of inflammation. (From *On the Use of Cold in Surgery*, 1861.)

Esmarch was proud but not boastful of his many accomplishments. His escutcheon, bestowed in 1887 by Emperor William I, included the Esmarch family arms, the Samaritan Cross, and a bloodless arm, exsanguinated by the Esmarch bandage. Indeed an appropriate collection of heraldic symbols for such a remarkable man who contributed so much to surgery, and to the compassionate and speedy care of the wounded.

ACKNOWLEDGEMENTS

The author is indebted to Professor J. J. Byrne of the Boston University School of Medicine for introducing me to the study of Medical History. Ms. Deborah E. Green assisted in translating from the original German.

REFERENCES

1. Baily, H., and Bishop, W.J.: *Notable Names in Medicine Surgery*. 3rd Edition, Charles C. Thomas Co., Springfield, Ill, 1959.
2. Bier, A: Friedrich von Esmarch. *Chirurgie* 7:287, 1935.
3. Boyes, J.H.: *On the the Shoulders of Giants: Notable Names in Hand Surgery*, pp. 81-83, J.B. Lippincott Co, Philadelphia, 1976.
4. Esmarch F.: *On Resection in Gunshot Injuries*. Kiel,

Carls Schroder & Co., 1851.

5. Esmarch, F., and Kowalzig, E.: *Surgical Technic; a Textbook on Operative Surgery*. Translated by L. H. Grau and W. N. Sullivan, Macmillan Co., New York, 1901.

6. Esmarch, F., and Schmidt, H.: *Jugenderinnerungen des Chirurgen Friedrich von Esmarch*. Heide, Boyen and Co. 1938.

7. Esmarch, F., and Kulenkampff, D.: *Die Elephantischen Formen*. Hamburg, Richter, 1885.

8. Esmarch, F.: *Chronic Inflammation of the Joints (Ger.)*, Kiel: Schweser', 1866.

9. Esmarch F.: *Concerning the Treatment of the Wound of President Garfield*. Translated by R. Stansburg Sutton, Boston Med. & Surg. J. 107:234-237, 1882.

10. Esmarch, F.: *Early Aid in Injuries and Accidents*. Translated by H.R.H. Princess Christian, Henry C. Lea's & Co., Philadelphia, 1883.

11. Esmarch, F.: *Handbuch der Kriegschirurgischen Technik*, Kiel, Lipsius & Tischer, 1885.

12. Esmarch, F.: *The Art of the Bloodless Operation (Ger.)*. Sammlung Klin Vortrage 58:373-384, 1873.

13. Esmarch, F.: *The First Dressing on the Battlefield*. Translated by T. Guy, Kiel, Schweser, 1870.

14. Esmarch, F.: *The Surgeon's Handbook on the Treatment of Wounded in War*. Translated by H. H. Clutton, Schmidt, New York, 1878.

15. Esmarch, F.: *Ueber Chronische Gelenkentzündungen*. Kiel, Schweser, 1867.

16. Esmarch, F.: *Ueber den Kampf der Humanit at gegen die Schrecken des Krieges..* Stuttgart, Deutsche Verlag-Anstalt, 1899.

17. Esmarch, F.: *Ueber Gelenkneurosen*. Kiel, Schers, 1872.

18. Esmarch, J.F. von, and Kowalzig, E.: *Surgical Technic-A Textbook on Operative Surgery*. MacMillan Co., New York, 1901.

19. Esmarch, F.: *On the Use of Cold in Surgery*. Translated by E. Montgomery, London, New Syudenham Society, 1861.20.

20. Garrison, F.H.: *An Introduction to the History of Medicine*, pp. 594 and 891. W. B. Saunders Co., Philadelphia, 1929.

21. Obituary: Friedrich von Esmarch. *New York Med. Journal* 87:412, 1908.

22. Obituary: Friedrich von Esmarch. *The Lancet* 1:755, 1908.

23. Obituary: His Excellency Johann Friedrich August von Esmarch. *British Med. Journal* 1:719, 1908.

24. Paul, U.: Friedrich von Esmarch. *Zentrabl. Chir.*, 105:549-550, 1980.

²⁵. Ritter, G.: Friedrich von Esmarch. Arch. F. Orthop., 7:1-6, 1909.

²⁶. Romm, S.: Johann Friedrich August von Esmarch. Plast. Reconstr. Surg., 71:271-273, 1983.

²⁷. Schmauss, A.K.: Das chirurgische Erbe. Johann Friedrich August von Esmarch—Leben und Werk. Zentralbl. Chir., 108:1577-1583, 1983.

²⁸. Talbot, J.H.: A Biographic History of Medicine Excerpts

and Essays on the Men and Their Work. Grune and Stratton, New York, 1970.

²⁹. Wagensteen, O.H., and Wagensteen, S.D.: The Rise of Surgery, pp. 37, 59, 597 and 625. University of Minnesota Press, Minneapolis, 1978.

³⁰. Zobeltitz, H.: A Day in the House of Friedrich von Esmarch on His Seventieth Birthday. Translated by B. S. Keete, Med. Mag. 2:9-21, July, 1983.



AcroMed[®] Corporation

. . . for new approaches in
spinal alignment and spinal
stabilization.

3303 CARNEGIE AVENUE - CLEVELAND, OHIO 44115 - 216/431-9900