Abdominal Pedicle Flaps To The Hand And Forearm

John C. Kelleher
M.D., F.A.C.S.

Interplast
Healing Bodies, Changing Lives

Global-HELP Publications

Chapter Two:
HISTORICAL REVIEW OF FLAP RECONSTRUCTION OF THE HAND From 1890 to 1945

During this period of time, eleven case reports were found in the English written literature describing abdominal pedicle flaps for reconstruction of the hand. I found that throughout the history of pedicle flap coverage of the hand the problems that existed with early reconstructions are still some of the problems that plague us today.

1898: Biggs, M.D., of Boston, described a flap to a contracted palmar burn scar of the left hand. The case was presented before the Boston Society for Medical Improvement on May 7, 1900. It was then reported in the Boston Medical and Surgical Journal of October 25, 1900.

The article describes a release of palmar scar and coverage with an abdominal flap that was based just below the sternum. It is interesting to note that the surgeon used a paper pattern to define what limits of the flap, a technique that is still used today.

1900: W. E. Schroeder, M.D. described two cases performed by Christian Fenger, M.D., as well as cases of his own. Dr. Schroeder was Associate Professor of Surgery at Northwestern University Medical School. These cases were reported in the American Journal of Medical Sciences, 120:435, 1900.

One of the cases described was that of Dr. Fenger's, which was performed around 1890. In this report, Dr. Schroeder noted a number of principles and precautions:

1. No more than a quarter of an inch of subcutaneous fat should be taken with the skin.
2. No tension or twisting of the pedicles.
3. The skin must have some subcutaneous fat or its viability would be endangered.
4. The edges of the skin of the hand must be undermined a quarter of an inch to allow attachment with sutures.

1905: A case was reported by James S. Stone, M.D., of Boston in the Boston Medical and Surgical Journal of March 2, 1905.

This article reviewed the treatment of a woman with a palmar burn scar contracture that was treated with a superiorly based abdominal flap.

Dr. Stone made some technical points in this article:

1. All deep scar tissue should be resected.
2. All resistance to complete unfolding of the contracture should be overcome.
3. The edges of the skin, which are left, should be free from scar as much as possible.
4. The incisions to raise the abdominal flap should be accurately patterned with allowance for shrinkage of about one-fourth to fit the denuded surface.
5. The raised flap should include about 1 cm. of subcutaneous fat. He felt that more was objectionable in appearance and was unnecessary to maintain the nutrition of the flap
6. He felt that suppuration was inevitable because of the exposed tissues.
7. No reconstruction on the bones or tendons should be done at the time of flap application because of this inevitable suppuration.
8. The stem of the flap to be severed at 18 to 20 days.

1908: Restoration of the Palm with Skin Flap from the Thigh by R. W. Westbrook, M.D. A

case report presented in the Long Island Medical Journal, Vol. 20, 1908, and presented at the Brooklyn Surgical Society.

This article described a flap reconstruction to the palm and dorsum of the hand using a flap raised from the upper one-third of the thigh. Most of the flap was used to reconstruct the palmar surface, and skin grafts were applied to the dorsum of the hand.

1917: Plastic Flap from the Abdomen for Burn of the Hand by Clarence A. McWilliams, M.D., presented before the New York Surgical Society in 1917 and published in the Annals of Surgery, Vol. 66, 1917.

This report described a 21 year old man with burns on the dorsum of the hand, which had healed by secondary intention.

The scar was excised, and the reconstruction was done with a bipedicled abdominal flap.

1919: Skillern, in June of 1919, presented a case of hand reconstruction by double pedicled abdominal pocket flap before the American Orthopedic Clinical Day conference at Jefferson Hospital in Philadelphia.

This report described an injury to the dorsum of the hand from a sanding machine that avulsed all of the skin off the dorsum of the hand down to the bone. It was treated with a bipedicled pocket flap. The author made the following points in the article:

1. The flap must be large enough both in width and length so that the coverage can be obtained without tension.
2. "The flap must include all the fatty tissue that can be obtained from the donor site; if a great deal of fat is not included, the flap will be a failure."
3. Perfect hemostasis must be obtained.
4. Strict attention must be paid for asepsis.
5. The flap must be properly immobilized.

1924: Reconstructive Surgery of the Hand by Sterling Bunnell, M.D. Surgery, Gynecology, and Obstetrics (S. G. & O.), September 1924, Vol. 64, No. 3, 1924. In this article, Sterling Bunnell, M.D., often referred to as the "father of modern hand surgery," cites a number of important principles:

1. Maintain the position of function of the hand and the mobility of the joints.
2. Use the tourniquet to reduce the trauma of sponging and to allow more accurate dissection.
3. It is important to photograph the initial injury along with accurate diagrams and notations of the finding, such as: sensation, range of motion, scars, and lacerations.

1937: Pedicle Flap Patterns for Hand Reconstruction by George Warren Pierce, M.D., and Gerald Brown O'Connor, M.D., San Francisco, CA, appearing in S.G.&O., Vol. 65, pages 523-527, 1937. This was read before the Industrial Medicine Surgery Section of the California Medical Association on May 25, 1936.

This was a discussion of principles involving flap coverage of the hand that covered numerous principles:

1. The usual donor sites for the hand are the abdomen, lower chest, thigh, and buttocks.
2. A one piece pattern of the exact size, shape, and thickness will give the most efficient result.

3. All flaps, when possible, should be made to conform to Langers' lines.
4. Venous stasis is most often responsible for tissue necrosis. This is caused, most often, by torsion or kinking of the stem of the pedicle. They concluded that multi-pedicle flaps tend to correct this venous deficiency problem.
5. All donor areas should be approximated or closed with a split thickness skin graft to diminish the possibilities for infection.

1940: Transplantation of Skin and Subcutaneous Tissue to the Hand. Sumner L. Koch, M.D., F.A.C.S., S. G. & O., 72:157, 1941. This report was read before the Minneapolis Surgical Society, Minneapolis, Minnesota, February 1, 1940.

In this article, Dr. Koch reviews principles of skin grafting to the hand as well as the application of flaps to the hand.

1944: One Stage Abdominal Tubed Flap, Darrel T. Shaw, M.D., F.A.C.S, Robert L. Payne, Jr., M.D., S. G. & O., 1944. This article describes a one stage single pedicle abdominal tube flap based on the superficial inferior epigastric vessels. This flap was found to be practical, reliable, rapid, and effective for coverage on hand injuries. They described flaps varying in length from 5 – 18 cm. and width from 3 – 7 cm. This article also cited another publication in the Surgical Clinics of North America, 1944, April, pages 293-308.

1946: Plastic Problems in the Hand, Sterling Bunnell, M.D., presented before the American Association of Plastic Surgeons, June 3, 1946, Toronto, Ontario, Canada. This was also published in Plastic and Reconstructive Surgery, Vol. 1:265, 1946. In this lecture and article, a number of enduring principles were elaborated:

1. Nutrition of the affected part from the binding cicatrix which is then replaced by good elastic pedicled tissue.
2. In estimating the size of the pedicle needed to replace the excised cicatrix, one-third more is added to all dimension.
3. When supplying new skin to the hand, the amount should be ample to cover the hand when both the hand and wrist are in flexion. The border of the flap should be patterned with indentations and points.
4. Too much fat left on a flap is parasitic and an additional burden to the blood supply. Fat should be trimmed from the skin leaving just enough fat for coverage of the subdermal plexus and the passage of tendons if needed.
5. "In supplying pedicle skin to the many thousands of injured hands in our army hospitals, the direct abdominal flap in one stage, which is time saving, has been the method of choice, except where the tubed pedicle was needed or preferable."