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MUSCULOSKELETAL COMPLICATIONS OF HEMOPHILIA: THE JOINT

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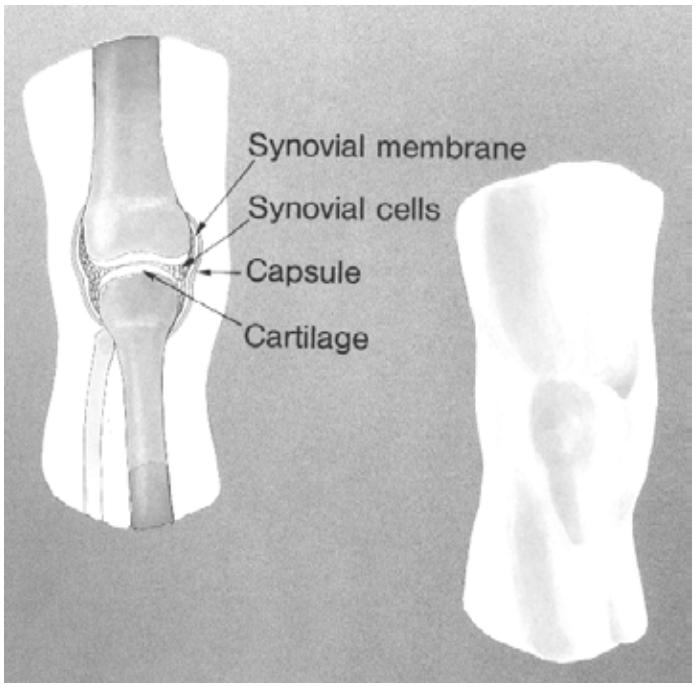
Musculoskeletal Complications of Hemophilia: The Joint

Marvin S. Gilbert

Orthopedics is the medical specialty that deals with afflictions of the locomotor system, that is to say, disorders of the bones, joints, muscles and peripheral nerves. It is of interest that the word orthopedics has no direct relationship to any of these structures, but is derived from the Greek “ortho” (straight) and “pedia” (child). Literally, the word means “straight child”. It is in hemophilia that it is most appropriate in that the orthopedist is asked to straighten the bent limbs of the child. However, because of hematological advances of the past decade, it has become our aim to prevent the child from ever becoming bent, to keep the child straight so that he or she can participate in all the normal activities of his or her peers.

In the early 1800s, arthritic joints were reported in persons with hemophilia, but it was not until 1868 that Volkmann stated that in hemophilia "bleeding into joints occurred either spontaneously or following minimal trauma." In 1892, König, an orthopedic surgeon, attempted to operate on several affected knees, but was not able to control bleeding by surgical means alone. The demise of the patients allowed him to study the joint and he was the first physician to show that the arthritis associated with hemophilia is directly linked to bleeding into the joint. The orthopedic community seemed to abandon hemophilia following König's failures until the 1950s when Henry Jordan tried to stop bleeding and correct contractures with casts and braces. In the 1960s, factor replacement became reality and many orthopedic interventions, including physical therapy, surgical tendon lengthening, joint replacement and arthroscopy could be used to alleviate the effects of past bleeding. The challenge of the next century is to prevent any of these musculoskeletal complications from ever occurring.



Normal Knee Joint

Illustration by Bernard P. Woschek

The Acute Bleeding Joint (Acute Hemarthrosis)

The most common sites of bleeding in hemophilia are the joints and muscles of the arms and legs. The vast majority of bleeding occurs into the joints of the extremities, although bleeding may occur into most any joint. There appears to be a predilection for large joints, namely the ankles, knees, hips, elbows and shoulders. Spontaneous bleeding into joints is limited to persons with severe hemophilia. Bleeding may occur following trauma in patients with mild and moderate hemophilia. Clinical manifestations of factor VIII and factor IX deficiency are indistinguishable.

I would like to point out why bleeding occurs into the joint cavity and the reasons that the characteristic arthritis termed "hemophilic arthropathy" develops following recurrent bleeding into the joint.

König pointed out that there were three clinical stages to the development of hemophilic arthropathy. He termed the first the “recurrent bleeding” stage. Following this, there is an inflammatory response and he termed this the panarthritis stage. The third and last stage he called the fibrosis stage and contracture commonly known as arthritis. He was able to point out that bleeding is not a common manifestation of the last stage.

Margaret Swanton followed a series of hemophilic dogs and in 1959, she described the natural history of bleeding into a joint. A diffuse hematoma first develops in the synovium which eventually extends into the joint cavity. Following reabsorption of the bleeding, there is an inflammatory response in the synovial tissue. This causes the tissue to swell and become filled with blood vessels. Recurrent bleeding then occurs and the synovium begins to produce enzymes which cause further inflammation within the joint. Eventually the bleeding causes destruction of the synovium and it is replaced with scar tissue. This is referred to as fibrosis. However, following the bleeding, the iron that is left deposited in the joint and the enzymes that are produced by the synovium begin to cause changes in the smooth cartilage that lines the end of the bones. The cartilage breaks down and becomes roughened. These changes eventually result in an arthritic and destroyed joint.

The clinical picture of joint bleeding is characterized by pain, swelling and limitation of motion. Frequently the patient states that he knows he is bleeding prior to any of these findings. This period has been termed the “aura”. It may be accompanied by mild stiffness and sometimes the patient describes a feeling of tightness or tingling. It is believed that this corresponds to the time when the bleeding is limited to the synovium. Once the bleeding fills the joint, it becomes warm, swollen and tense. Limitation of motion and secondary muscle spasm follow. When treatment is started early, the bleeding will stop quickly and the symptoms may recede quickly. However, it is very common for the symptoms to resolve slowly and at times the bleeding may recur despite what seems to be adequate treatment.

A joint that displays a tendency towards recurrent bleeding has been termed a "target joint" by Aronstam. Once a target joint is established, complete resolution is possible, but more commonly there is a slow response to treatment and arthritis will develop.

No joint hemorrhage is so minor that treatment may be deferred or postponed, and no plan of treatment is complete unless it includes replacement of the missing clotting factor to a level sufficiently high to stop the bleeding. This level must be maintained long enough to stop the bleeding and to prevent recurrence. At the present time, episodic replacement therapy is the mainstay of treatment in hemophilia. Most spontaneous hemarthroses respond to a single infusion of factor VIII or factor IX, which achieves a level of 30% to 40%. If swelling or spasm is present, treatment to levels of 50% is usually required and the infusions may have to be repeated at 12- to 24-hour intervals. Many patients are on programmes of home care. Follow-up for minor bleeding episodes that respond to a single infusion of factor can be left to the discretion of the educated and motivated person or family with hemophilia, but physician evaluation is required if the joint of bleeding does not respond within 12 to 24 hours.

Minor hemarthroses may not require immobilization, but some individuals find relief from elastic bandages, foam rubber splints or slings. Some people find that ice helps in the relief of pain. Severe hemarthroses, in which there is swelling, spasm or infection of the joint, should be treated with splinting in a position of comfort. Prefabricated splints, bulky compression dressings, or home-made plaster splints can be used. Attempts at correcting the deformity should be deferred until bleeding has been stopped; this will be discussed in the next section. Rest is required for resolution of the acute symptoms, but, in the long run, rest will lead to limitation of motion and muscle atrophy. Therefore, joint rehabilitation must be started as soon as possible, beginning with isometric exercises. As soon as the acute symptoms subside, muscle strengthening and range of motion exercises must be started.

Bleeding into the joint does result in pain. Analgesics may be required to alleviate this and should be carefully monitored by the treating physicians. Any aspirin-containing compound is contraindicated because of the risk of further bleeding due to inhibition of platelet function. Intramuscular injections should be avoided. The use of narcotics may be required when the pain is severe, but indiscriminate use must be discouraged because of the chronic nature of the bleeding and the risk of addiction. Oral steroids have been shown to decrease the inflammatory processes associated with bleeding and are used at many hemophilia centers. Despite the well-known complications, few problems have been associated with their use for three to four days following an acute bleeding episode. Recommended regimens include Prednisone, 1 to 2 mg/kg/day, for three to four days. Non-steroidal anti-inflammatory medications (NSAIDS) have not proven very beneficial in decreasing the acute inflammatory reaction and probably should be avoided in acute bleeding episodes because of their inhibition of platelet function and the potential to enhance bleeding. Their judicious use, however, may be helpful in controlling arthritic pain and will be discussed in the next section.

Aspiration or removal of blood from the joint with a syringe and needle can be considered. Theoretically, the early removal of blood from the joint should result in a more rapid response to treatment and should be beneficial in delaying or eliminating the development of arthritis. The disadvantages are that the patient must either come to a physician's office or to a hospital

emergency room. A secondary problem is that young children will frequently delay reporting a hemarthrosis to their parents because “they don't want to be stuck with a needle in the joint”. The definite indications for aspiration include: (1) a tense and painful joint which has not responded to factor replacement within 24 hours; (2) pain which seems out of proportion to the physical or clinical findings; (3) evidence of neurovascular or skin compromise; and (4) a joint in which the pain pattern is unusual or there is an elevated temperature. The last criterion requires that a septic joint be ruled out.

Contraindications to aspiration include the presence of an inhibitor that cannot be controlled and local factors, such as an open wound or infected overlying skin. When aspiration is performed, it should be done at the time of factor replacement when levels of 50% are achieved. A large bore needle, at least 16-gauge, should be used as small clots frequently clog smaller needles. Immobilization with a plaster splint or compression dressing helps relieve symptoms and may prevent recurrent bleeding. A second infusion of factor, 12 to 24 hours after the aspiration, is frequently recommended.

The importance of physical therapy and the role of the therapist must be stressed. The aim is to increase function by maintaining range of motion, increasing muscle strength, and avoiding joint deformity. Prophylactic factor replacement may be required if the pain and swelling have not completely resolved. If there is any concern, factor replacement should be used prior to the first few physical therapy sessions. After a week or two, the exercises are usually continued by the patient without factor replacement. These exercises should be done at home on a regular basis. The programme of therapy should be individually tailored by the physical therapist to the patient's needs and lifestyle.

The Chronic Swollen Joint (Recurrent Bleeding and Synovitis)

If joint bleeding is not adequately treated, it tends to recur. The inflamed, swollen synovium bleeds more easily than normal synovium and causes further swelling and inflammation. This vicious cycle must be broken to prevent the iron within the blood and the enzymes from destroying the cartilage, leading to the development of arthritis.

Synovitis or recurrent bleeding can be differentiated from an acute hemarthrosis in that the swelling does not respond to a single infusion of factor. The joint is less painful than with an acute hemarthrosis and the range of motion is frequently not limited. It must be remembered that cartilage has a limited ability to repair itself. The synovitis may not be painful, but the destruction is insidious and cumulative and, therefore, the condition must be treated as vigorously as a painful hemarthrosis.

Prophylaxis, or preventative replacement of the missing clotting factor, for three to six months is indicated. The intermittent use of steroids helps reduce the inflammation within the joints. A dose of 1 mg/kg/day of Prednisone for one week should be followed by a dose of .5 mg/kg/day for a second week. If the synovitis is recalcitrant, the course may be repeated in three to six weeks.

Aspiration may be useful initially to control the swelling with the joint and should be undertaken after prophylaxis has been started but before steroids are used. Immobilization is useful at times but must be used in conjunction with physical therapy to prevent atrophy and loss of range of motion.

A lack of response of the recurrent bleeding of synovitis after three to six months of prophylaxis and treatment is usually considered an indication for more aggressive intervention. Open surgical synovectomy, arthroscopic synovectomy and radioactive synovectomy should then be considered. The indications and management of these procedures will be considered in a later monograph.

The Arthritic Joint (Hemophilic Arthropathy)

Despite early and what seems to be adequate treatment, the progression of bleeding and synovitis to arthropathy have not been eliminated. Only prophylactic replacement of the missing clotting factor started soon after the first bleeding episode holds promise of doing this, but it is not economically or medically feasible in most parts of the world. To minimize the consequences of an hemarthrosis which has not responded or cannot be adequately treated with factor replacement, short-term immobilization should be considered. This can lead to further deformity. Isometric exercises should be started immediately and should quickly progress to more vigorous strengthening exercises and range of motion exercises.

For recalcitrant joints, the temporary use of braces and splints have proven beneficial. A prefabricated sports brace can be useful. They usually have a hinge that can be locked and opened to allowed progressive motion, especially at the knee. A molded ankle-foot orthosis will frequently control pain and bleeding at the ankle. High shoes and orthoses can be inexpensive and have been used to minimize foot and ankle problems. Temporary splinting may be used to control pain and bleeding at the elbow, but long-term use is not feasible as it interferes with function. Again I must stress that physical therapy must be used in conjunction with all forms of splinting.

If a flexion contracture has developed at the knee, cast correction is indicated. Serial casting, wedge casting and the use of desubluxation-type hinges have been successful in correcting these contractures. Serial casting can be used on an outpatient basis. Wedge casting works more quickly but usually requires that the patient be admitted to the hospital. A desubluxation hinge is used if there is any evidence of posterior subluxation or if the contracture is greater than 45º. Following correction, the patient is kept in a brace until physical therapy has strengthened the muscles around the knee, especially the quadriceps. This usually takes three to six months.

The Future

Until now, the role of the orthopedic surgeon in the care of the person with hemophilia has been to correct the ravages of bleeding into the joints, muscles and other structures in the extremities. It has become obvious that the only way to prevent musculoskeletal problems is to correct the hematological defects; these forms of relief will come from the hematologist and the geneticist. Until then we must work to maintain the normal function of the hemophilic joint and, by utilizing some of the principles outlined in this paper, it is hoped that the children throughout the world will be able to keep a “straight” stature.