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Bleeding Disorders

Bleeding is commonly understood as a loss of blood from the vascular system either internally in the body or externally through a natural orifice or break in the skin. Normal bleeding time following most soft tissue injuries is less than 5 minutes. Prolonged bleeding time may indicate a bleeding disorder. This entry focuses on how these disorders may concern people who are active in exercise and sporting activities, identifies the sporting events and activities that are acceptable or unacceptable for people with bleeding disorders, and describes how treatment is rendered and how to monitor these athletes on a continual basis.

Normal Bleeding and Clotting

Blood carries vital nutrients within a liquid made up of plasma, red and white blood cells, and platelets. Plasma, a mixture of water, sugar, fat, and protein, also contains many chemicals that help form the clots necessary to stop bleeding. Red blood cells carry oxygen to all parts of the body. White blood cells fight infections and disease. When an injury occurs, platelets gather at the site of the injury and adhere to the edges of the wound, where they release chemicals that help start the process of clotting so that bleeding will stop.

To understand what is *abnormal* bleeding associated with bleeding disorders, we must first understand the *normal* process of how our bodies bleed and clot. Bleeding occurs in approximately four stages. (This process is the same for both external and internal bleeding.)

Stage 1: The platelets in the blood activate and form a plug over the injured skin or vessel. This plug lasts for 12 to 24 hours.

Stage 2: A substance called Von Willebrand factor reacts with the platelets to increase the "stickiness" of the platelets to each other and the surrounding collagen or tissue.

Stage 3: Further platelet recruitment is involved via local hormone messengers such as fibrinogen and thromboxane.

Stage 4: Activation of the clotting factors, produced by the liver, forms a series of reactions and stabilizes the bleed even further. These factors are XII, XI, IX, and VIII to VII and X, and V. Notably, a deficiency of Factor VIII—which is Hemophilia A—is the most common factor deficiency that causes a bleeding disorder.

Common Types of Bleeding Disorders

The three most common bleeding disorders in athletes are as follows:

1. *Von Willebrand disease* (VWD), an inherited disorder of platelet function (reflected by prolonged bleeding time) and a partial deficiency of functional Factor VIII, which occurs in about 1 in 100 people
2. *Hemophilia,* an inherited deficiency of Factor VIII or IX, which occurs in about 1 in 10,000 people
3. *Immune thrombocytopenic purpura* (ITP), which is an autoimmune or drug-induced disorder

Signs of a Bleeding Disorder

Athletes with bleeding disorders may show the following signs:

- Athletes with VWD usually have mucosal (nasal and gastrointestinal) bleeding. In women, it also includes heavy menstruation.
- Hemophilia in contact athletes is characterized by bleeding into a joint cavity (hemarthrosis), such as the knee, or into muscles. Prolonged bleeding times in the face of a skin injury can occur as well.
- Crops of little red blanched dots on the skin known as petechiae, along with purpura or bruising, may signal thrombocytopenia, low platelets, or ineffective platelet function.

Any bleeding disorder may be worsened by the use of aspirin or anti-inflammatory drugs, which can affect platelet function and therefore prolong bleeding. A physician along with a hematologist can diagnose a bleeding disorder. Routine tests such as cell blood count (CBC) will look for low platelets, anemia (low hemoglobin), prothrombin time (PT), and partial thromboplastin time (PTT). Prolonged PTT can be the initial clue in the diagnosis of hemophilia or VWD. Like hemophilia, VWD will have a prolonged bleeding time.

Treatment

Treatment immediately after an injury includes activating the PRICE regimen: *p*rotect, *r*est, *i*ce, *c*ompression, and *e*levation. Athletes with mild cases of VWD are treated with DDAVP (desmopressin), and those with active bleeding are treated with Factor VIII concentrate.

Treatment for hemophilia is often given when bleeding has started or when the doctor knows that clotting factor replacement will be needed, such as before surgery. This is known as treatment "on demand." Recently, however, doctors have started prescribing clotting factor replacement to young people on a regular basis to try to prevent bleeds from starting. The goal is to ensure that joints and muscles are less likely to be damaged in the future. This preventive type of treatment is known as prophylaxis.

ITP is generally limited to children. Cases usually cease when the offending drug is stopped (e.g., antibiotics such as trimethoprim/sulfamethoxazole or vancomycin, or antacids such as famotidine or ranitidine). However, a case was reported of a professional football player who developed ITP after taking quinine sulfate for muscle cramps. In adolescents and young adults, most cases of ITP are autoimmune related and require corticosteroids, IV (intravenous) immunoglobulin, and, in some cases, a splenectomy.

Activity Prescription

Recent decades have seen a shift in attitudes and approaches to bleeding disorders and sports. Formerly, hemophiliacs were overprotected and told to be as physically inactive as possible. In many cases, physical activity was forbidden. They were kept indoors, often not allowed to go to school, and not allowed to engage in activities that could be perceived as high risk.

The main authority on exercise, the American College of Sports Medicine (ACSM), does not publish guidelines on activity and bleeding disorders. Even the *Preparticipation Physical Evaluation* monograph, a guide that helps physicians screen medical conditions during routine preseason physicals in sports, simply recommends further evaluation for anyone with a bleeding disorder. This leaves the decision of whether to participate to the athlete and his or her health care team: the primary care physician, the hematologist, the athletic trainer, and, in the case of children, the parents.

In general, however, athletes with hemophilia and VWD are precluded from contact sports, specifically collision sports such as football, basketball, soccer, and rugby. The research varies, and some experts believe that contact sports may be allowed in mild cases of ITP if the platelet counts are above 100,000 per cubic millimeter.

There is a consensus among physicians that good physical condition and well-trained musculature in athletes can reduce the incidence of spontaneous bleeding. Rochelle Tiktinsky and colleagues observed a marked decrease in bleeding complications among hemophiliacs after progressive resistance training. It has been demonstrated that physical activity enhances the concentration of various coagulation factors without raising the number of bleeding episodes cased by the training program.

Classifying Sports: Contact Versus Noncontact

The medical and sports industries have created ambiguity in defining who may or may not participate in which sports. Some sports have been ranked as high risk based on the frequency of injuries, even though those injuries are relatively mild. Some sports, such as snowboarding, in which the injuries can be catastrophic, are ranked as medium risk. Interestingly, basketball and soccer both appear on the American Pediatric Society list as "contact" or "collision" sports but are classified as medium risk in most hemophilia publications. The need for clarity and consistency to guide athletes and their health care teams is apparent.

What is more important in identifying risk for an athletic patient with hemophilia or VWD is to match the athlete and the activity according to the biomechanical requirements of the sport and the physical

abilities of the participant. This is being done in Germany. Biomechanical analysis, including angular acceleration, is measured for different sports to calculate joint stresses. Children with hemophilia are assessed for balance and coordination, flexibility, muscle strength, endurance, and body mass. The results of the assessment are then compared with the demands of the child's chosen sport. If the analysis shows that the joints and muscles are up to the task, the child is allowed to play. If deficiencies are found in certain areas that the sport requires, the child is advised to choose another sport or to correct those deficiencies before trying to play.

Conclusion

Physical activity is advocated for the general population. It has been linked to favorable effects on heart disease, hypertension, obesity, diabetes, osteoporosis, high cholesterol, and emotional states. Through appropriate participation in sports, people with bleeding disorders can develop good physical condition and motor coordination, which may prevent musculoskeletal problems and speed recovery after joint and muscle bleeds. Participation in activities that are normal and desirable parts of social life confers not only physical but also psychosocial advantages.

In any sport or physical activity, those with bleeding disorders need proper physical conditioning. They must know the rules, have the skills to play, go through proper warm-up, and use appropriate protective equipment. Education concerning the player's bleeding disorder is imperative for the coaches, trainers, and parents. Most important, if an injury does occur, proper treatment must be readily available.

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See also Abrasions and Lacerations; Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)

Further Readings

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Blisters

Blisters occur where there is excessive friction over the skin. For this reason, they are frequently called *friction blisters.* This differentiates them from blisters caused by heat or solar injury, infection, medications, or other medical conditions. Friction blisters generally occur on the soles and heels of the foot; however, they may also form on the palms in athletes who are active with their hands, such as rowers and gymnasts. Although more common in active populations because of the repetitive movements in athletics, all people are susceptible to friction blisters.

Anatomy

The skin has three layers. The deepest layer is called *subcutaneous tissue* and is composed of adipose (fat), nerves, hair follicles, arteries, veins, and sweat and oil glands. The middle layer is the *dermis.* It has two layers and varies in thickness depending on the location in the body. The deepest