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Arm Complications After Manual Whole Blood Donation and Their Impact

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ABSTRACT

Arm complications after whole blood donation occur in approximately 30% of donations. The 2 most common arm complications are contusion/hematoma (23%) and arm pain (10%). A variety of arm complications were evaluated from a national donor complication database, clinical studies, and review of the literature. The incidence of nerve injuries, arterial punctures, contusions/hematomas, and other complications were based on observations and reports at blood drives, interviews 3 weeks after donations, and donor reports of outside medical care. The clinical course of each complication is described.

Complications from whole blood donation can be divided into those affecting the donor's body, for example, vasovagal reactions, fatigue, and those affecting only the donor's arm [1].

The Phlebotomy Process

Donors are eligible for a 450- or 500-mL phlebotomy and a minimal additional blood sample for post–blood donation testing. The blood donor's identity is confirmed before phlebotomy. The donor may be asked about iodine or latex allergies because the phlebotomist uses an iodine-based antiseptic solution to prepare the antecubital area and wears latex gloves. An allergic reaction can occur to both substances. However, recently, some blood centers changed from a 2-step process with iodine-based antiseptic solutions to a 1-step process using a 2% chlorhexidine and 70% isopropyl alcohol antiseptic solutions because it is more effective and convenient [2,3]. The donor may recommend which arm and vein should be used, but the final decision is determined by the phlebotomist. In an anterior-facing arm, the selected vein should be in the center or lateral aspect of the antecubital fossa. It should not be done in the medial antecubital area because it contains more superficial nerves and increases chances for their injuries [4]. After selecting the optimal vein, the area surrounding the venipuncture site (eg, 3 × 3 in) is scrubbed with an antiseptic solution for 30 seconds. In a 2-step process, this is repeated with a solution of equal or greater concentration for another 30 seconds. The solution should dry before the phlebotomy.

The phlebotomy is performed with a large-bore needle to ensure adequate flow, which minimizes the risk of clotting and prevents hemolysis. The mean phlebotomy time with a 16-gauge needle is 7 minutes [5], with a lower limit of 4 minutes. Ninety-four percent of donations at American Red Cross (ARC) in 2006 were completed within 4 to 13 minutes. A phlebotomy time of 3 minutes or less is suggestive of arterial puncture. Ideally, the phlebotomy should be performed without repositioning the needle after the initial venipuncture, as adjustment(s) theoretically increases the risk of nerve or tissue injury. Repositioning, however, may be necessary to maintain adequate blood flow. If good blood flow cannot be maintained, the needle is removed and the phlebotomy set, including all bags, is discarded. If the donor approves and if the donor's total blood loss is within that blood center's established limits, a new venipuncture set can be used for a second phlebotomy.

Donor Arm—Blood Vessel Complications

Table summarizes donor arm complications and their incidence, which are discussed individually below (unpublished data [American Red Cross Donor Hemovigilance Program], 2006-2007) [6–12].

Contusions and Hematomas

A contusion (bruise) is flat, discolors the skin, varies with time, and disappears when the contusion is healed. A hematoma, in contrast, is raised. Both a contusion and a hematoma can coexist. Contusions and hematomas result from blood leakage after needle punctures of the vein and remain the most common complications.

The incidence of hematomas or flat blood leakage at blood drives is between 0.32% and 1.05% [9–12]. Contusions and hematomas are more common in women (1.33%) than men (0.78%) ($P < .0001$) and more common in first-time donors (1.44%) than repeat donors (0.96%) ($P < .0001$). There does not appear to be a specific relationship to age. [12]. Post–donation interviews of 1000 donors found that 22.7% of donors had contusions and 1.7% had hematomas [7]. The contusion rate was higher in women than in men (30.6% vs 13.2%, $P <$

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Table
Incidence of Donor Arm Complications

	Incidence by observation or donor reports (%)	Incidence by interview (%)	Incidence requiring medical care (%)
I. Blood vessel complications			
Contusion (bruise)	NA	22.7 [7]	0.0046 [12]
Hematoma	0.32-1.05 [9-12]	1.7 [7]	0.0046 [12]
Arterial puncture	0.014 [12]	NA	0.0009 [12]
DVT	NA	NA	NA
II. Sore arm/nerve injury complications			
Pain/Sore arm	NA	10.0 [7]	NA
Nerve injury	0.016-0.032 [6-12]	0.9 [7]	0.0037-0.0048 [6,8,12]
III. Other complications			
Local allergic reaction	0.001 [12]	NA	NA
Arm infection/thrombophlebitis	NA	NA	NA

Abbreviation: NA, not available.

.0001), and there was a tendency to have a higher contusion rate in whites than in blacks (23.7% vs 13.2%, $P = .06$). Hematomas were also more common in women than in men (2.9% vs 0.4%, $P < .004$) [7].

Donors may be concerned when a large or painful hematoma develops, when the hematoma changes color, or when the healing process takes longer than usual. Blood centers provide written post–donation advice and telephone consultations. Blood centers can refer donors to medical care providers. In the ARC system, 0.0046% of donors (1/20 000) sought outside medical care for a contusion or hematoma [12]. This is a small fraction of the ~23% of donors who develop a contusion. A contusion did not affect blood donors' return rate [10,13].

Selection of the vein, the needle size, the needle's bevel sharpness, the correct tightness of the tourniquet, and the phlebotomy entry technique are all thought to influence the hematoma and contusion rates. To prevent hematoma formation after phlebotomy, pressure should be applied to the venipuncture site. The donor can also be instructed to raise the arm to lower the venous pressure and possibly improve the puncture site clot. The venipuncture site is bandaged, and donors are advised to not use that arm strenuously for a specified period to prevent any increase in venous pressure, which might break the hemostatic seal and cause bleeding. In 1992, a UK study revealed that improved post–phlebotomy care could decrease the rate of contusion occurrences and their size. Contusion incidence and size were recorded in 100 consecutive patients 24 hours after phlebotomies [14]. The staff was then instructed to ensure that direct pressure led to complete hemostasis before the patient was released. The contusion rate in the next 100 consecutive patients dropped from 45% to 25% ($P < .01$), and the percentage of contusions more than 100 mm^2 decreased from 76% to 36% ($P < .01$). This experience showed that changing the procedure could significantly reduce the incidence and size of contusions.

Arterial Punctures and Associated Complications

Arteries are thick-walled, rigid vessels, and their blood is contained in a high-pressure system. The diagnosis of an arterial puncture is clinical and is based on a short collection time ($\leq$3 minutes) or a combination of short collection time and bright red blood. Alternatively, the diagnosis could be based solely on a pulsating needle or pulsating tubing because the pulsation indicates that the needle is in the artery. A pulsating needle occurs in only about one-third of arterial puncture cases [15].

Arterial punctures are rare. In the ARC, the incidence of an arterial puncture or possible arterial puncture is 0.014% (1/7300) [12]. Arterial punctures are more common in men (0.013%) than women (0.009%) ($P < .0001$), more common in first-time donors (0.018%) than in repeat donors (0.011%) ($P < .0001$), and more common in donors younger than 30 years (0.019%) than donors older than 30 years (0.010%) ($P < .0001$) [12]. One study reported that inexperienced phlebotomists are more likely to puncture an artery [15]. Multivariate logistic regression analysis of arterial punctures from 2001 through 2004 found that men and young donors were at higher risks for these punctures, but first-time donors were not [16].

Collection should be discontinued immediately when an arterial puncture is recognized. Theoretically, the pulsations caused by differences in the pressure could enlarge the puncture site and increase the risk for a hematoma or even permanent nonclosure. The hematoma rate after an arterial puncture is approximately 33% [15] in comparison with 0.32% to 1.05% after venous punctures [9–12]. This rate is for 16-gauge needles; hospitals using 20- to 25-gauge needles for brachial artery punctures have much lower hematoma rates [17–20].

Except for the high incidence of hematomas, donors with arterial punctures do well. Just 6% of such donors contacted health care providers, and with its low frequency, the total incidence of medical care for an arterial puncture for all donors was 0.0009% (1/107 440) [12]. For treatment, 10 minutes of pressure applied to arterial or suspected arterial punctures helps ensure closure, but no study has evaluated the optimal duration for direct pressure and its effect on the incidence of hematomas. One must take care to ensure that the venipuncture site has hemostatically sealed before releasing the donor. Anticoagulated autologous donors should be alerted that internal swelling, pain, or paresthesias in the extremity may require immediate attention.

Failure of the arterial puncture hole to close can lead to pseudoaneurysm formation, arteriovenous (AV) fistulas, or compartment syndrome. These complications are very rare. Four of 13 experienced blood center physicians reported 1 or more pseudoaneurysms in their careers, but none of the 13 had ever observed an AV fistula or a compartment syndrome [9].

Pseudoaneurysm

Pseudoaneurysm refers to the hematoma that develops when the arterial puncture site permanently fails to close. The hematoma is not surrounded by an arterial wall and, therefore, is called *pseudoaneurysm*. Pseudoaneurysm is the most common serious complication after an arterial puncture. Its incidence varies from 0.1% to 0.4% of all arterial punctures.

Pseudoaneurysms in an 18-year-old man [21], a 49-year-old man [22], and a 60-year-old woman [23] after donations have been reported. All 3 immediately developed hematomas, and 2 were pulsatile [21,22]. The donors continued to have blood leakage and variable clinical courses lasting for 2 weeks [23] to 3 months [21]. One developed paresthesias [22]. These diagnoses were confirmed by color-flow Doppler ultrasound or surgery. Vascular surgery was required in each patient to evacuate hematomas and any additional thromboses and repair arterial sites. All recovered completely.

Arteriovenous Fistula

An AV fistula is an abnormal vascular connection between an artery and a vein. It is created when both vessels are punctured and an anastamosis is established between them. Arteriovenous fistulas

related to blood donation are very rare. An AV fistula generally presents as a pulsating, elongated mass, usually with a thrill (vibration) and bruit. Both an AV fistula and a pseudoaneurysm pulsate cause bruits, but an AV fistula also has a thrill and may have distal distended veins. Rarely, both lesions may be present.

Four patients with well-described AV fistula resulting from phlebotomy have been reported [24–27]. Three cases were related to whole blood donations, and the fourth [25] was related to collecting a blood sample. The patients ranged in age from 23 to 27 years. Three were men, and the other relating to a blood sample was a woman. The range in ages suggests that this condition may be more common in young adults. In 3 cases, thrills and bruits were noted, and in the fourth one, there was only a bruit. One person had distal venous distension [26], 1 had prominent veins [27], but 2 had no venous distension [24,25]. Angiograms confirmed the diagnoses. Surgery to remove the AV fistula reestablished normal blood flow. The surgery was straightforward and was often performed with regional anesthesia. All 4 patients recovered without complications. In contrast to other AV fistulas, these lesions did not cause high-output cardiac failure and were easily managed.

Compartment Syndrome

Compartment syndrome is caused by rapid arterial bleeding into a closed anatomical space. They usually cause tense-feeling muscles, disproportionate pain, diminished distal pulses, distal paresthesias, and loss of limb function. Increased intracompartmental pressure confirms the diagnosis. Disproportionate pain warrants immediate surgical decompression, followed by a fasciotomy to ensure decompression. Decompression and fasciotomy should be performed as early as possible to maximize benefit and prevent further damage. A delay can lead to loss of function and necrosis, necessitating amputation in some patients.

Compartment syndrome after donation is exceedingly rare, with only 2 reported cases. One donor was a 71-year-old woman who developed swelling at the right antecubital venipuncture site 1.5 minutes into the donation [9]. The venipuncture was stopped, pressure was applied for 10 minutes, and a pressure bandage was placed. The donor lost feeling in her right arm within 4 hours and was hospitalized with a hematoma ($10 \times 5 \times 3$ cm) under her right bicep. The hematoma was evacuated, and a fasciotomy was performed in her right upper arm. She recovered completely. The other occurred in a 67-year-old man after a whole blood donation [28]. The donation was apparently without incident, but his compression bandage bundled up and acted as a tourniquet. He developed pain within 24 hours in his left arm, and by 48 hours, edema and neuromuscular dysfunction in the median nerves developed in the left hand. This diagnosis of compartment syndrome necessitated fasciotomy 3 days after donation. Surgery revealed a large hematoma at the venipuncture site, which was evacuated. Subsequently, he developed fever. Group A *Streptococcus* was found in the wound. Multiple debridements were performed, but ultimately, his left hand was amputated. The cause of compartment syndrome in this man appeared to be both the hematoma and obstruction from the compression bandage.

Compartment syndrome also occurs in those receiving anticoagulants. This applies to autologous donation because anticoagulant use is a contraindication to allogeneic blood donation. No case has been reported after an autologous blood donation, but one case was reported after a simple venipuncture. A 52-year-old man taking warfarin for atrial fibrillation had a blood sample drawn from the left arm with a 21-gauge needle. Twelve hours postvenipuncture, his left forearm was tense and swollen with diffuse muscle tenderness and severe discomfort on passive wrist extension. He presented to the emergency room with left forearm pain and swelling 36 hours after collection of the blood sample. He underwent a fasciotomy, and a large hematoma was removed. His symptoms improved, and he was discharged 24 hours later [29]. Other cases of compartment syndrome were reported in anticoagulated patients after arterial punctures [30,31].

Upper-Extremity Deep Venous Thrombosis

Upper-extremity deep venous thrombosis (DVT) is rare after whole blood donation, with 2 reported cases [32,33]. The first patient was a 20-year-old woman presented with increasing pain, antecubital tenderness, a contusion, and swelling in her right arm 5 days after donation [32]. A brachial-basilic thrombus was found by duplex ultrasonography. She was anticoagulated for 6 months and remains well. Test results for hypercoagulation risk factors were negative. The only known clinical risk factor was her use of oral contraceptives. The other patient was a 44-year-old, healthy woman presented with a tender, painful left antecubital fossa the day after her 11th donation [33]. The pain persisted and increased gradually over the next month, radiating up the medial aspect of her left upper arm. Her discomfort became unbearable. Her left arm was stiff and tender and nonedematous. A venogram revealed a large thrombus in the median cubital vein. She was anticoagulated and made an uneventful recovery. The donor had no risk factors, for example, oral contraceptives, or any hematologic disorders.

Most primary non–donation-related upper-extremity DVT cases are caused by excessive movement of the arm and are more common in young men in the right arm. Many secondary cases are caused by venous cannulation and are seen in an older, sick population [34–36]. Almost all of the nondonation cases develop in veins that are more central than the brachiocephalic vein, for example, the axillary and subclavian veins. Pulmonary emboli are rare after upper-extremity DVT. Hughes [37] and others [34–36] found no pulmonary emboli. Recently, a few pulmonary emboli cases have been reported, with the greatest incidence being 3 (12%) in 25 cases [38]. Chronic edema, recurrence, or discomfort occurs in 64% to 79% of patients with DVT [35,36,38].

The donors in the 2 donation-related DVT cases completely recovered. These cases may differ because they are related to venous cannulation, occurred in healthy individuals, and occurred more distally in the brachiocephalic vein or its branches. Prompt diagnosis and treatment relieved the symptoms, and there were no recurrences or any chronic symptoms.

Donor Arm—Sore Arm/Nerve Injury Complications

Sore Arm

Arm soreness may be related to soft tissue injury or to injury to a tendon or ligament. A sore arm can be differentiated from a nerve injury based on clinical symptoms (see below). Donors may complain of a sore arm at the collection site, but data are not collected on these complaints. More commonly, donors self-diagnose a sore arm the next day or thereafter when the pain is persistent. During interviews, 10% of 1000 donors reported a sore arm [7]. The report was more common from women than men (12.5% vs 6.9%, $P < .005$) and more common from first-time than repeat donors (14.5% vs 9.1%, $P < .05$). There are no data on the percentage of donors with sore arms who sought care elsewhere.

In a follow-up on donor return rates using negative binomial regression analysis, donors who reported just a sore arm were 2% less likely to return to donate than donors who had no adverse event ($P = .06$). For donors who complained of both sore arm and fatigue, the return rate was 65% less than in donors with no adverse event ($P = .07$ for synergy). If a donor complained of sore arm, fatigue, and a vasovagal reaction, the return rate was 85% less than in donors without an adverse event ($P = .012$ for synergy) [13]. It is apparent that a sore arm alone has a minimal affect on donor return rates, but there appears to be synergy with other donation adverse events. Good phlebotomy technique can minimize the incidence of painful arms.

Nerve Injury (Irritation)

Nerve injury is usually immediately apparent. Sixty-five percent of donors report a sharp, lancinating, burning, or electrical pain that radiates to the lower arm or into the hand or fingers and, in some cases, also proximally [6]. Eighty-two percent of donors with suspected nerve injury report paresthesias distally [6]. Paresthesias may be described as tingling, numbness, burning, or a prickly feeling. In one study, 41% of the donors reported these symptoms at the blood drive, 48% reported them 1 to 10 days later, and 7% reported them weeks later, when the donor finally determined that it was clinically significant [6].

Incidence and Causes

The incidence of a nerve injury was 0.9% among 1000 donors interviewed 3 weeks after a whole blood donation [7]. The incidence of nerve injuries voluntarily reported by donors was 0.016% (1/6300) at one ARC blood center [6] and is consistent with the 0.032% (1/3119) incidence for nerve injury and severe pain reported at all ARC blood centers in 2006 and 2007 [12]. The dramatic difference between the incidence by interview (0.9%) and from voluntary donor reports (0.016%-0.032%) shows that 96% to 98% of cases are minor and not sufficiently significant to warrant reporting. The low frequency with which donors report their nerve injuries and the transient nature of almost all nerve injuries has led to the use of an alternative term, "nerve irritation," instead of "nerve injury"; either term is acceptable. The reported incidences of consulting a physician or obtaining other medical care are similar across institutions, being 0.0037% (1/26 700) [8] and 0.0048% (1/21 000) [6] at 2 blood centers, and 0.0043% (1/23 456) at all ARC blood centers [12].

In a study of 66 donor nerve injuries from 419 000 whole blood donations, 65% involved women, and the donors tended to be 8 to 9 years younger than the mean population of women [6]. Three other studies confirmed a disproportionate number of women (79%-82%) [39–41].

Cutaneous nerve injuries are usually caused by the needle directly contacting and injuring a nerve or nerve branch. Cutaneous nerves usually are beneath the superficial antecubital veins, but a study of 7 pairs of arms from autopsies showed that nerves were also above, next to, or intertwined with the vein [42]. The relative position of the nerve to the vein sometimes changed during the vein's course. Nerve injuries are unavoidable because nerve anatomy is variable and nerves cannot be palpated. One study showed that 40% of nerve injuries occurred with a "clean" venipuncture, without needle adjustments, hematomas, or difficulties with the venipunctures [39]. The size of the needle makes a difference. In a rodent study, one-third of rats who had a surgically exposed tibial nerve punctured with an 18-gauge needle developed pain symptoms and/or subsequent axonal degeneration, but the frequency of nerve injury was much lower with smaller needles [43]. Pressure from a hematoma may also cause a nerve injury. The incidence of hematomas among donors with nerve injuries is 24% [6], much higher than the incidence of 0.32% to 1.05% in nonaffected donors [9,10,12].

Clinical Course

Follow-up on 56 donors with nerve injuries revealed that 39% recovered in less than 3 days, 30% in 4 to 29 days, 23% in 1 to 3 months, 4% in 3 to 6 months, and 4% in 6 to 9 months [6]. Donors who recovered in less than 3 days did not seek medical attention, whereas 29% of the donors with 3- to 29-day recoveries, 62% of the donors with 1- to 3-month recoveries, and 100% of the donors with greater than 3-month recoveries sought medical care. Three donors had mild sensory changes but no functional impairment at 14 to 19 months after donation [6]. Another blood center reported on 6 cases, and the donors also had full recoveries [8].

Treatment of Nerve Injuries

Symptomatic treatment for pain and discomfort is suggested for their nerve injuries, and donors should be given the option to seek other medical opinions. An overwhelming percentage of donors recover fully without any treatment, and rehabilitation is almost never needed or considered.

Prevention of Nerve Injuries

A single straightforward, smooth venipuncture should minimize the risk of nerve injury. Multiple needle punctures or needle adjustments, although often necessary, theoretically increase the risk. The phlebotomist should respect the wishes of the donor to stop the venipuncture and should also stop the venipuncture if it is readily apparent that the donor's pain is severe or that the attempt will not be successful. An ongoing educational program to improve or maintain high skill levels may be beneficial.

General Complications

Permanent nerve injuries are thought to be rare but remain the most common cause of donation-related long-term morbidities (longer than a year) and disability. A study in Denmark reported that from 1997 to 2003 in 2.58 million donations, there were 559 reported nerve injuries for an incidence of 1 in 4606 donations or 22 per 100 000 [44]. This is similar to the incidence of nerve injuries reported in the United States [6,12]. Ninety-five percent of the long-term morbidity cases (121 of 126 cases) in Denmark and 97% of the disability cases (56 of 58 cases) were a result of nerve injuries. The incidences on long-term morbidity and disability were 4.7 and 2.2 per 100 000, respectively. In 68 donors with long-term morbidity and no disability, the main problems were pain in the arm when using it (39 patients), pain and sensory changes (17 patients), or just sensory changes (9 patients). In 56 nerve injury cases with long-term morbidity and disability, 52 were mild impairments (5% disability). The donors had pain and paresthesias in the arm, without functional impairment. The other 4 had 8% to 15% disabilities, and the donors had functional arm impairments. There is no equivalent study of long-term morbidity or disability for blood donation–related nerve injuries in the United States, but subjectively, the results from Denmark appear to be much higher than what is observed in the United States.

Chronic Regional Pain Syndrome

A severe permanent nerve injury, although rare, can be life-changing. In such cases, the donor develops severe symptoms during the donation or shortly thereafter and never recovers. This syndrome is classified as chronic regional pain syndrome (CRPS), which develops after a relatively minor injury to the arm but lasts much longer and is much more severe than normally expected. Type II CRPS is present when the pain can be traced to an identifiable nerve injury [45].

Horowitz [40] described the clinical course of 30 patients who developed type II CRPS after donation, blood sample collection, intravenous line placement, or drug injection. The pain was always temporally related to the event and was constant and intense. Patients described it as burning or electrical and radiating, and it was usually associated with paresthesias. All patients obtained medical attention within a few days. Within weeks in the mild cases or 3 to 6 months in the severe cases, the pain metamorphosed into "dull," "boring," or "aching" chronicity. The acute pain recurred intermittently, superimposed on the chronic pain, and could occur spontaneously, but more often, it was stimulated mechanically, either by movement of the arm or by touch. The arm was often immobilized by placing the extremity close to the torso with shoulder adduction and elbow flexion at the elbow. This posture reduced the frequency of exacerbations. Six patients (20%) had nearly complete recoveries. Twenty-four patients (80%) had pain for years.

Diagnosing CRPS is straightforward because of the temporal relationship to the precipitating event, the characteristic symptoms,

and positive neurologic findings. A positive electromyographic (EMG) test result confirms the diagnosis, but a negative EMG test result does not exclude it. Electromyographic tests are of limited value for several reasons. First, CRPS may be caused by damage to small nerve fibers such as C-nociceptive or Aδ fibers. These small fibers cannot be detected by EMG testing [40,46,47]. Second, the nerves being tested have many branches and varying anatomy, even between arms, and therefore, it is difficult to maximally stimulate the muscles or to make comparisons with the opposite arm. Third, the sensory nerve action potential and nerve conduction velocities are difficult to evaluate. Also, EMG changes have no prognostic value because they do not correlate with the clinical findings [40,46]. Therapies for CRPS include analgesics, anti-inflammatory drugs, tricyclic antidepressants, anticonvulsant medications, transcutaneous electrical nerve stimulation, nerve blocks, stellate ganglion blockades, and sympathectomy. These treatments generally have transitory or modest benefits [40]. New treatments are being developed to address the mechanism of this pain [48].

Donor Arm–Other Complications

Local Allergic Reactions

Iodine-based antiseptic solutions, latex gloves, adhesive tape, gauze, and bandages usually contact with the donor's venipuncture site and skin during or after phlebotomy. These products are tested by the manufacturers for irritation and sensitization properties by standard techniques before the Food and Drug Administration approves their use. Donors are generally asked about allergy to iodine, and some blood centers also ask about latex allergy. If the donor is allergic to iodine, a non–iodine-based antiseptic solution, for example, chlorhexidine, should be used. If the donor is allergic to latex, nonlatex gloves should be used. Hypoallergic tape is also available. Recent studies suggest that a 1-step process using a chlorhexidine 2% in 70% alcohol antiseptic solution is an effective and more convenient process to kill skin bacteria [2,3,49–53]. However, the allergic reaction rate increases in donors when chlorhexidine 2% in 70% alcohol is used; in a recent large study comparing 144 400 plateletpheresis donations using a 2-step iodine procedure with 73 200 plateletpheresis donations in a later period using chlorhexidine 2% in 70% alcohol, the allergic rate increased from 0.008% to 0.14% [2]. Allergic reactions were generally mild and self-limited, and donors were given the option on the next donation to revert back to a 2-step iodine solution.

There were 123 local allergic reactions reported by all ARC blood centers, an incidence of 0.001% (1/100 000) [12]. Local allergic reactions were more common in women (0.0013%) than in men (0.0008%) ($P < .0001$), more common in first-time donors (0.0018%) than in repeat donors (0.0008%) ($P < .0001$), and more common in 16- to 19-year-old donors (0.0022%) than in donors 20 years and older (0.0008%) ($P < .0001$).

Infection and Thrombophlebitis

Infection and thrombophlebitis at the antecubital puncture site after donation are uncommon. The exact incidence remains unknown because data on these occurrences are compiled in a miscellaneous group. Infections are often cellulitis and require warm soaks and antibiotics. Thrombophlebitis is usually recognized by the presence of a linear red streak originating from or near the puncture site. If it is warm, reddened, and painful, infection most probably is present and antibiotics would be indicated. Otherwise, thrombophlebitis is customarily successfully treated with heat and symptomatic pain relief until it resolves. Fifteen cases of antecubital-fossa thrombophlebitis were reported during World War II [54]; none caused pulmonary emboli.

Summary

A variety of complications after whole blood donations involve the arms. Contusions and hematomas are the most common and need more focus on how to prevent/minimize them. Contusions do not appear to decrease donor return rates. A sore arm is common, and it does not significantly decrease the donor return rate by itself, but does when it is combined with fatigue and/or a vasovagal reactions. The most significant complication is nerve injury or irritation. These injuries are not preventable because the exact locations of the nerves are unknown, and the nerves cannot be palpated. Almost all nerve injuries resolve, but in a small number of cases, it may take months, and in rare instances, there may be permanent injury. Nerve injuries are the most common cause of disability among donors. Arterial punctures often lead to hematomas (33%), rarely to pseudoaneurysms, and very rarely to AV fistulas or compartment syndromes. Reported local allergic reactions and thrombophlebitis are uncommon, and post–donation DVT is rare. Although considerable data on donor arm complications already exist, future studies may increase our understanding of these complications.

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