

# Complications Occurring from Diagnostic Venipuncture

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**Background.** Venipuncture is the most common invasive medical procedure performed by health care providers. While venipuncture is considered to be reasonably safe, the present study investigated the incidence of serious complications occurring in an outpatient setting.

**Methods.** Venipuncture was performed on insurance applicants at their home or place of work. Four thousand fifty venipunctures were performed over a 3-year period. Minor complications were defined as bruising and hematoma at the venipuncture site. Serious complications were defined as cellulitis, phlebitis, diaphoresis, hypotension, near syncope, syncope, and seizure activity.

**Results.** Minor bruising and hematoma were fairly common, involving 12.3% of venipunctures, with minor bruising being the most common reaction. Serious complications were observed in 3.4% of patients. Diaphoresis with hypotension occurred in 2.6%. Syncope occurred in less than 1% of patients. There were no serious local reactions such as cellulitis or phlebitis observed in this study.

**Conclusions.** Serious complications can occur as a result of venipuncture even when only a small volume of blood is withdrawn; therefore, medical personnel should be prepared to provide appropriate care.

**Key words.** Syncope; hematologic tests; hematoma.

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Venipuncture for diagnostic or screening tests has become increasingly common. Minor complications (eg, bruising and hematoma formation) as well as more serious vasovagal reactions have been studied.<sup>1-4</sup> Most reports of venipuncture complications have used blood donors as the study group. In these patients, a minimum of 200  $\mu$ L of blood is usually withdrawn. The rate of adverse reactions has been shown to be related to the patient's sex, age, race, previous donor experience, the amount of blood taken, and degree of anxiety.<sup>1-3,5</sup> The present study was undertaken from October 1988 to April 1991 to determine the complications of venipuncture in an outpatient setting with small blood volumes typical of diagnostic venipuncture.

## Methods

Venipunctures were performed in conjunction with insurance examinations. Nearly all of the venipunctures were done at each patient's home or business. A 20- or 22-gauge needle was used for the venipuncture, and no more than 30  $\mu$ L of blood was withdrawn from any

patient. Patients were always seated, or in a supine position if a previous reaction to venipuncture was indicated by the patient. The veins at the antecubital area were exclusively used. The tourniquet used was either the Velcro type or a blood pressure cuff inflated to 40 mm Hg. The use of the blood pressure cuff was reserved for only those patients with veins that were difficult to visualize or palpate. The tourniquet was applied, an alcohol swab was used at the site of venipuncture, venipuncture was performed, the tourniquet was either deflated or removed, the needle was withdrawn, gauze was placed over the site, and pressure was applied.

Obvious bruising or hematoma formation was noted. Patients who experienced lightheadedness, diaphoresis, or syncope were instructed to lie down and elevate their legs. Telephone follow-up was done with the patient or his or her agent to determine whether delayed bruising or any other reaction had occurred.

Bruising, hematoma, and pain were defined as minor complications. Bruising was noted either at the time of venipuncture or 48 hours afterward. Hematoma formation always occurred just after venipuncture. Pain was defined in this study as the patient having undue discomfort and requesting that the needle be immediately withdrawn.

The following were considered to be serious complications: diaphoresis and near syncope (evidenced by

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Table 1. Complications Occurring in 4050 Patients Undergoing Venipuncture, by Severity of Complication

Complication	Total (N=4050) No. (%)	Men (n=3200) No. (%)	Women (n=850) No. (%)	P Value
Minor				
Bruising	416 (10.3)	176 (5.5)	240 (28.2)	<.001
Hematoma	80 (2.0)	36 (1.1)	44 (5.2)	<.001
Pain	80 (2.0)	40 (1.3)	40 (4.7)	<.001
Total	576 (14.2)	252 (7.9)	324 (38.1)	<.001
Serious				
Diaphoresis, near syncope	105 (2.6)	95 (3.0)	10 (1.2)	<.005
Syncope	24 (0.6)	24 (0.8)	0	<.02
Convulsive syncope	6 (0.1)	5 (0.2)	1 (0.1)	NS
Ventricular tachycardia	1 (<.1)	1 (<.1)	0	—
Total	136 (3.4)	125 (4.0)	11 (1.3)	<.001

NS denotes not significant.

the patient having diaphoresis and poor facial coloring); syncope (resulting in unconsciousness); and convulsive syncope (syncope with tonic-clonic movements).

The data were statistically evaluated using chi-square and *t* tests.

## Results

Venipuncture was performed on 4050 patients from October 1988 through April 1991. Men (3200) outnumbered women (850) by a ratio of 3.76 to 1. Bruising was the most common minor reaction and was more common in women than in men (Table 1). Overall minor reactions occurred in only 14.2%, with minimal bruising being the most common. In cases in which the blood pressure cuff was used as a tourniquet, bruising was more severe. Delayed bruising occurred in some cases, causing bluish-yellow discoloration of the entire arm. Pain and hematoma were more common in women than in men. Local cellulitis or phlebitis was not observed.

Serious adverse reactions occurred in 3.4% of the 4050 clients, with the overwhelming number occurring in men (Table 1). Diaphoresis with near syncope was the most commonly observed serious reaction (2.6%). Syncope occurred in 29 men and 1 woman (Table 2). Five men and one woman experienced convulsive syncope. None had any previous history of seizure disorder. The incidence of syncope was related to age: syncope was more common in young men than in older men. Only 3 cases of syncope occurred among the 1404 men over 40 years of age, ie, an incidence rate of one in 468. For men under 40 years of age, however, the incidence rate was one in 69. The incidence of syncope for both men and

Table 2. Occurrence of Syncope Following Venipuncture in 4050 Patients, by Age and Sex

Patients' Age and Sex	No.	Syncope No. (%)	Incidence Rate
Men and women	4050	30 (0.74)	1:135
Men*	3200	29 (0.90)	1:110
<40 y†	1796	26 (1.45)	1:69
>40 y†	1404	3 (0.20)	1:468
Women*	850	1 (0.12)	1:850
<40 y	478	1 (0.20)	1:478
>40 y	372	0	—

\*P < .01.

†P < .01.

women was one case per 135 patients. The overall mean and median age for men experiencing syncope was 30 years and 28 years, respectively.

Finally, one 62-year-old white man without a history of heart disease and a previous difficulty with venipuncture suffered ventricular tachycardia. During the venipuncture he became diaphoretic. The procedure was discontinued, and the patient placed in a supine position with his legs elevated. The patient denied chest pain or pressure. Five minutes following the venipuncture, an electrocardiogram was performed. Multiple runs of ventricular tachycardia were detected, which then converted to a bigeminy rhythm. The patient refused hospital care on the basis that this had happened to him once before, when he was about to have gallbladder surgery, and had resulted in admission to the cardiac care unit.

## Discussion

Venipuncture is the most common invasive medical procedure. It is thought to be reasonably safe and it results in few complications. Most of the information regarding complications resulting from venipuncture has come from studies related to transfusion or blood donation.<sup>1-4</sup> The major limitation of these studies is that large volumes of blood are withdrawn, making it difficult to distinguish vasovagal reactions from those of transient relative hypotension. This is particularly true for young, healthy women who have relatively low baseline blood pressures. In studies by Ogata et al<sup>4</sup> and Turkeltaub and Gergen<sup>5</sup> the amount of blood withdrawn was reduced to 200 mL and 80 mL, respectively. In the present study, no more than 30 mL was withdrawn from each patient, suggesting that the serious complications that were observed resulted from the venipuncture itself, not from the volume of blood withdrawn.

Bruising was the most common complication observed in our study, and was more common in women than in men. This finding is probably related to the size

of the veins, narrower in women than in men. Hematoma formation was also more frequent in women. The hematomas were treated with ice if noted just after venipuncture. Bruising and hematoma formation can be reduced if adequate pressure on the venipuncture site is maintained for 3 to 5 minutes. Unfortunately, patients often apply only minimal pressure for minimal time, despite advice, and consequently, unnecessary bruising or hematoma formation occurs.

Potential serious complications such as near syncope, syncope, and convulsive syncope occurred predominantly in men. Only one woman experienced syncope. The reason for this disparity may be related to the experience with venipuncture that the majority of the women had experienced during perinatal care. It is not uncommon for vasovagal syncope to be associated with tonic-clonic movements mimicking epilepsy.<sup>6</sup> This variant has been called convulsive syncope and occurs in patients without neurologic disease. Electroencephalographic monitoring during such an episode reveals diffuse slowing, but no epileptiform activity.<sup>6</sup>

Studies of the incidence of vasovagal syncope occurring in male and female blood donors have been mixed. One study indicated that the incidence of syncope was higher among women,<sup>7</sup> another showed a higher rate among young men than young women, and little difference between rates of older men and women<sup>2,8</sup>; still other studies have noted no difference in the incidence of syncope by sex.<sup>5,9</sup> It may be that these various results reflect diversity of the populations studied. The present study represents a distinct population: people who were applying for life insurance. Most of the younger women in the present study were married and had children; therefore, many had undergone blood tests and other medical procedures involving venipuncture as a result of pre- and postnatal care.

The present study shows that young men under the age of 40 years are at greatest risk for serious adverse complications from venipuncture, such as near syncope,

syncope, and convulsive syncope, and the resulting potential for head trauma and aspiration. Patients should always be seated during venipuncture. If syncope occurs, the patient should be placed in a supine position with his or her legs elevated. Fortunately, in the present study, all patients with syncope regained consciousness quickly and no trauma-related injuries occurred. The results of the present study suggest that the syncope observed following venipuncture of a small volume of blood is vasovagal and occurs almost exclusively in men. Syncope that occurs after blood donation may be related more to acute volume depletion and hypotension.

It should be noted that deaths have been reported that were related to blood donations.<sup>5</sup> It is therefore important not to underestimate the potential adverse risk of vasovagal reactions secondary to venipuncture and to be prepared for these emergencies.

#### References

1. Rueta PP, Johnson SA, Callahan R, Meade R, Smith J. Fainting: a review of its mechanisms and a study in blood donors. *Medicine* 1967; 46:363-83.
2. Beal RW. Vasovagal reactions in blood donors. *Med J Aust* 1972; 2:757-60.
3. Kleinknecht RA. Vasovagal syncope and blood/injury fear. *Behav Res Ther* 1987; 25:175-8.
4. Ogata H, Linuma N, Nagashima K, Akabane T. Vasovagal reactions in blood donors. *Transfusion* 1980; 20:679-83.
5. Turkeltaub PC, Gergen PG. The risk of adverse reactions from percutaneous prick puncture allergen skin testing, venipuncture and body measurements: data from the second National Health and Nutrition Examination Survey 1976-80 (NHANES 11). *J Allergy Clin Immunol* 1989; 84:886-90.
6. Grubb BP, Gerard G, Roush K, et al. Differentiation of convulsive syncope and epilepsy with head-up tilt testing. *Ann Intern Med* 1991; 115:871-6.
7. Williams GEO. Syncope reactions in blood donors. An investigation of 222 cases. *Br Med J* 1942; 1:783.
8. Report to the Medical Research Council Prepared by a Subcommittee of Blood Transfusion Research Committee. Fainting in blood donors. *Br Med J* 1944; 1:279-83.
9. Graham DR. Prediction of fainting in blood donors. *Circulation* 1961; 23:901-6.