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Current Transfusion Practices of Members of the American Society of Anesthesiologists

A Survey

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Background: **The last published survey of transfusion practices among members of the American Society of Anesthesiologists (ASA) was conducted in 1981. The ASA Committee on Transfusion Medicine conducted a new transfusion survey in 2002.**

Methods: **The survey was mailed to 2,500 randomly selected active ASA members. The previous survey was modified to incorporate questions based on the ASA Practice Guidelines for Blood Component Therapy. The chi-square test was used for comparisons. Two-tailed *P* values of 0.05 or less were considered as nonchance differences.**

Results: **A total of 862 survey responses were completed by anesthesiologists who provided or directly supervised anesthesia for patients who may have required transfusion. In a given week, 62% rarely or never transfused 3 or more units of blood to the same patient. The percentage of anesthesiologists who responded that it is never or rarely (1% or less of the time) necessary to cancel elective surgery because of unavailability of blood products was 96% in 2002. In 1981, 92% responded that it was rarely necessary, and 8% said that it was occasionally necessary. The percentage of anesthesiologists who required patients undergoing elective surgery to have a hemoglobin concentration of at least 10 g/dl decreased from 65% to 9% (*P* < 0.001). Before intraoperative erythrocyte transfusion, 89% of respondents performed hemoglobin or hematocrit determinations routinely or sometimes. Intraoperative autologous transfusion equipment availability increased from 39% to 95% (*P* < 0.001). Awareness of the ASA Guidelines was 72%.**

Conclusions: **Transfusion practices have changed considerably since 1981. Current transfusion practices are, in general, consistent with the ASA Guidelines.**

THE National Blood Data Resource Center, in its 1998 Nationwide Blood Collection and Utilization Survey, noted an alarming trend of decreasing numbers of blood donations and increasing numbers of blood transfusions.[1] A large percentage of allogeneic blood is administered in the operating room (OR), especially to cardiac surgery patients,[2,3] with 20% of transfusions thought to be inappropriate.[4] Blood shortages have been reported in many areas throughout the United States, necessitating delay of elective surgical procedures.

The annual cost of blood transfusions in the United States has been estimated at $5–7 billion.[5] However, it is likely that the actual costs are much higher as a result of more widespread use of leukocyte-reduced components and the introduction of nucleic acid testing of donated blood.[6,7] There is great variability among institutions in transfusion practices, especially for cardiac surgery patients.[2,8] Educational outreach has improved transfusion practice in surgery, but there is still significant variability, and many institutions do not use laboratory tests to guide transfusion therapy.[8–10]

Multiple consensus conferences and specialty society task forces have been convened in the United States to develop recommendations for the transfusion of blood components. These organizations include the National Institutes of Health,[11–13] the American College of Obstetricians and Gynecologists,[14] the American Association of Blood Banks,[15] the American College of Physicians,[16] the College of American Pathologists,[17,18] and the American Society of Anesthesiologists (ASA).[19] Educational programs can improve transfusion practices,[20] but many institutions may not provide any educational programs or transfusion guidelines.

The most recent survey of anesthesiologists' transfusion practice was performed in 1981 and published in 1987.[21] To assess current transfusion practices, identify changes in practice that have occurred since the 1981 survey, and determine the need for future educational endeavors, the ASA Committee on Transfusion Medicine conducted a survey of active ASA members in 2002. We also sought to determine whether members were familiar with the ASA Practice Guidelines for Blood Component Therapy (hereafter referred to as the ASA Guidelines) published in 1996[19] and whether they seemed to be following them.

Materials and Methods

The majority of the survey questions were identical to those on the previous survey so that the responses could

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be compared. Some questions were modified to incorporate responses based on the ASA Guidelines. Questions regarding the frequency of administering transfusions, the criteria for reinfusing predonated autologous blood, the use of whole blood, and intraoperative performance of hemoglobin determinations and coagulation tests were added. Demographic data regarding the member's practice location, years in practice, type of practice, and certification were included.

After institutional review board approval, the survey was mailed to 2,500 randomly selected active members of the ASA, representing approximately 10% of the active membership. A power analysis before performing the survey revealed that 750 respondents would result in an approximate precision for point estimates of ± 3.7% based on the half-length of a 95% confidence interval assuming a point estimate of 50%. We assumed a 30% response rate. Therefore, 2,500 surveys at a 30% response rate would result in 750 survey responses. The randomization was performed with use of a computer. Resident, affiliate, honorary, life, and retired members were excluded. The identity of respondents remained anonymous.

Statistical Methods

The number of respondents (*i.e.*, the denominator used to calculate the percentage response) dictates the precision of the corresponding point estimate. With 862 responses, the approximate precision for point estimates is ± 3.4% based on the half-length of a 95% confidence interval assuming a point estimate of 50%.

The percentages should total 100 within round-off error and excluded those who left the question unanswered or indicated that it was not applicable. In some questions, more than one answer could be given (Appendix 2, questions 5, 7, 9, 10, 11, 13, 15, 23, 25, and 32). We analyzed those questions on an individual response basis, and the total percentage response may be greater than 100%. In cases where additional questions are asked after an initial response, the percentage responses for the follow-up question were reported based on the total number of initial question responses (Appendix 2, questions 6, 8, 26, 27, and 28). For these follow-up questions, the total percentage may be less than 100% if responses were missing or greater than 100% if more than one answer could be given.

There were 389 respondents for the 1981 survey. Comparisons of 2002 to 1981 were made using the chi-square test for equality of endorsement percentages. In all cases, two-tailed P values of 0.05 or less were considered evidence of differences not attributable to chance.

Results

Of the 2,500 questionnaires mailed, a total of 1017 surveys were returned, for a 41% response rate. Of these, 862 respondents provided or directly supervised anesthesia for patients who required transfusion. Further analysis was based on this population of 862 anesthesiologists. A copy of the questionnaire is attached as Appendix 2.

The majority of respondents never or rarely (62%) or only one to five times a week (37%) transfused 3 or more units of blood to the same patient in a typical workweek. There was a change in the profile of the physician considered primarily responsible for ordering and administering blood products intraoperatively. In 1981, 53% said the anesthesiologist was responsible, 2% said it was the surgeon, and 45% considered it a joint responsibility. The responses in 2002 were 33%, less than 1%, and 67%, respectively ($P < 0.001$).

Demographic Data

The percentage of survey respondents certified by the American Board of Anesthesiology increased from 65% in 1981 to 97% in 2002 ($P < 0.001$). In 2002, 85% of all active ASA members were certified by the American Board of Anesthesiology. Table 1 shows that the percentage of respondents who render most of their anesthesia care in a subspecialty area is greater than in 1981 ($P = 0.017$ for cardiac; $P < 0.001$ for neurosurgical, obstetric, and pediatric). The major subspecialties were similarly represented in 2002: 9% cardiac, 9% neurosurgical, 10% obstetric, and 10% pediatric. The size of the primary hospitals where the anesthesiologists practice decreased, but the size of the populations in the areas where they practice increased (both $P < 0.001$). The percentage of anesthesiologists who described their anesthesia practice as academic increased from 16% in 1981 to 23% in 2002 ($P < 0.001$). According to ASA membership data, approximately 16% of active members belong to a university-associated group.

Seventy-eight percent of those surveyed in 1981 replied that their hospital had a transfusion committee, 11% said it did not, and 11% did not know. These responses differed from the 2002 responses of 82%, 6%, and 12%, respectively ($P = 0.007$). In 1981, 59% said there was an anesthesiologist on the committee; 65% replied affirmatively in 2002 ($P < 0.001$).

Blood Availability

The percentage of anesthesiologists who responded that it is never or rarely (1% or less of the time) necessary to cancel elective surgery because of nonavailability of blood products was 96% in 2002 (table 2). In 1981, 92% responded that it was rarely necessary, and 8% said that it was occasionally necessary. In 2002, 9% responded that platelets for intraoperative transfusion are never

Table 1. Demographic Characteristics of Respondents

	1981		2002		
	No.	%	No.	%	*P* Value
Majority of anesthesia cases*					
Obstetric	8	2	82	10	< 0.001
Pediatric	12	3	81	10	< 0.001
Cardiac	19	5	72	9	0.017
Neurosurgical	4	1	72	9	< 0.001
Combination of the above	NA		467	57	NA
Other	NA		258	31	NA
Hospital size					< 0.001
< 100 beds	17	4	66	8	
101–250 beds	87	22	222	26	
251–500 beds	164	42	364	43	
501–1,000 beds	98	25	170	20	
> 1,000 beds	23	6	17	2	
Community size					< 0.001
< 10,000	4	1	6	< 1	
10,000–50,000	67	17	66	8	
50,001–100,000	75	19	120	14	
100,001–500,000	94	24	259	31	
> 500,000	149	38	385	46	
Type of practice					< 0.001
Academic	64	16	191	23	
Private	316	81	596	71	
Other	9	2	51	6	
Time practicing					< 0.001
< 5 yr	58	15	86	10	
6–10 yr	97	25	217	25	
11–15 yr	63	16	194	23	
16–20 yr	54	14	157	18	
> 20 yr	117	30	199	23	

* Respondents could indicate more than one type.

NA = not available.

available unless arrangements are made preoperatively. In 1981, 31% indicated that it was difficult and 3% said that it was very difficult to obtain platelets for intraoperative transfusion in the absence of preoperative arrangements.

Use of Blood Conservation Techniques

The use of apparatus for intraoperative salvage and reinfusion of blood increased from 39% in 1981 to 95% in 2002 ($P < 0.001$). In 1981, 22% of the respondents replied that they had used acute normovolemic hemodilution; in 2002, 31% indicated that they had used the technique within the previous 12 months.

Transfusion Practice

In 1981, 46% of respondents did not know whether a maximum surgical blood-ordering schedule (MSBOS) was used in their primary hospital; 52% did not know in

Table 2. Blood Availability

	1981		2002		
	No.	%	No.	%	*P* Value
Cancel elective surgery because of nonavailability*					0.011
Never	NA		287	33	
Rarely (≤ 1% of the time)	358	92	538	63	
Sometimes (2–5% of the time)	27	7	31	4	
Frequently (≥ 5% of the time)	4	1	3	< 1	
Platelets available for intraoperative transfusion†					< 0.001
Never available unless arrangements made preoperatively	122	31	76	9	
Sometimes	13	3	54	6	
Usually	254	65	394	46	
Always	NA		335	39	

* To facilitate the calendar-year comparison, for the year 2002 the "never" and "rarely" responses were combined. † To facilitate the calendar-year comparison, for the year 2002 the "usually" and "always" responses were combined.

NA = not available.

Table 3. Responses to Survey Question 5*

Actions	1981 No.	1981 %†	2002 No.	2002 %	*P* Value‡
Healthy 3-month-old for hernia repair, hemoglobin 9.2 g/dl					
I would transfuse preoperatively.	12	3	2	< 1	< 0.001
I would administer general anesthesia without requiring blood availability.	358	92	665	80	< 0.001
I would require a type and screen before surgery.		NA	149	18	NA
I would require blood to be crossmatched before surgery.	86	22	19	2	< 0.001
15-yr-old boy with sickle cell anemia for arthroscopy of the knee, hemoglobin 7.5 g/dl					
I would transfuse preoperatively.	159	41	195	23	< 0.001
I would administer general anesthesia without requiring blood availability.	233	60	239	29	< 0.001
I would require a type and screen before surgery.		NA	299	36	NA
I would require blood to be crossmatched before surgery.	206	53	104	12	< 0.001
38-yr-old woman with menometrorrhagia for D&C, hemoglobin 8.5 g/dl					
I would transfuse preoperatively.	175	45	9	1	< 0.001
I would administer general anesthesia without requiring blood availability.	233	60	205	24	< 0.001
I would require a type and screen before surgery.		NA	491	58	NA
I would require blood to be crossmatched before surgery.	206	53	143	17	< 0.001
45-yr-old man with endstage renal disease for creation of arteriovenous fistula in the groin, hemoglobin 6 g/dl					
I would transfuse preoperatively.	78	20	272	32	< 0.001
I would administer general anesthesia without requiring blood availability.	214	55	103	12	< 0.001
I would require a type and screen before surgery.		NA	267	32	NA
I would require blood to be crossmatched before surgery.	237	61	203	24	< 0.001

* Survey question 5: Assume for each of the patients described that the surgery is necessary and that it should be performed within 48 h. Which of the following would you do? (Respondents were instructed to indicate all the actions they would perform.) † Percentages total 100 within round-off error and excluded those who left the question unanswered or not applicable. ‡ Two-tailed *P* value from chi-square test of equality.

D&C = dilation and curettage; NA = not available (type and screen was not an option on the 1981 survey).

2002 ($P = 0.114$). The use of a type and screen without crossmatch before surgical procedures in which transfusion might be required increased from 65% in 1981 to 87% in 2002 ($P < 0.001$). The percentage of anesthesiologists who require patients undergoing elective surgery to have a hemoglobin concentration of at least 10 g/dl decreased from 65% in 1981 to 9% in 2002 ($P < 0.001$). Table 3 shows that there were statistically significant differences in transfusion practices for all of the four case scenarios.

Table 4 shows that the responses to the methods used for estimating blood loss during major abdominal surgery changed from 1981 to 2002. Measuring the contents of suction containers decreased from 95% in 1981 to 91% in 2002 ($P = 0.01$). Visual estimation decreased from 88% in 1981 to 82% in 2002 ($P = 0.005$). Use of serial hemoglobin and/or hematocrit determinations increased from 45% in 1981 to 81% in 2002 ($P < 0.001$). Weighing sponges decreased from 48% in 1981 to 26% in 2002 ($P < 0.001$).

In the 1981 survey, erythrocytes were reported to be transfused by 15% of respondents only if vital signs changed (*i.e.*, blood pressure decreased, pulse rate increased significantly). In 2002, 52% relied primarily on vital signs ($P < 0.001$). One third of anesthesiologists in 2002 transfused before estimated blood loss approached 20% of estimated blood volume; 42% used this criterion in 1981 ($P = 0.002$). A response indicating transfusion of erythrocytes to adults only if more than 1 U is required changed from 18% in 1981 to 12% in 2002 ($P = 0.002$). In 2002, 13% indicated that allogeneic whole blood was available in their institutions. Sixty-one percent of respondents to the 2002 survey indicated that they used the same criteria for reinfusion of preoperatively donated autologous blood as for allogeneic blood, whereas 38% transfused autologous blood more liberally.

The reported practice of reconstituting or diluting erythrocytes with crystalloid (vast majority using normal saline) increased from 69% in the 1981 survey to 87% of respondents in the 2002 survey ($P < 0.001$). This practice was performed to decrease the viscosity of the erythrocyte units. The use of micropore filters for all erythrocyte transfusions increased from 37% in 1981 to 60% in 2002 ($P < 0.001$). Use of blood warmers for all erythrocyte transfusions increased from 48% in 1981 to 89% in 2002 ($P < 0.001$).

The primary indications for requesting that platelets be available were a platelet count below a specified value and surgical procedures usually associated with significant blood loss. In 1981, 80% replied that they requested platelets to be available in the first situation, specifying a mean platelet count of 68×10^9/l. In 2002, 89% of the respondents requested that platelets be available for patients with a mean platelet count of 74×10^9/l ($P < 0.001$) and significant anticipated blood loss. In 1981, 33% requested that platelets be available if more than one blood volume replacement was required; 56% responded similarly in 2002 ($P < 0.001$).

A question regarding platelet transfusion practices, which had response choices based on the ASA Guide-

Table 4. Transfusion Practices

	1981		2002		
	No.	%	No.	%	*P* Value
Methods of measuring blood loss usually used during major intraabdominal surgery in adults*					
Visual estimation	342	88	697	82	0.005
Measuring contents of suction containers	370	95	776	91	0.010
Weighing sponges	187	48	225	26	< 0.001
Serial hematocrit and/or hemoglobin determinations	175	45	691	81	< 0.001
In operative procedures that do not always require blood replacement, which of the following best describes your usual approach?*					
Transfuse when blood loss approximates 10% of estimated blood volume	23	6	10	1	< 0.001
Transfuse before estimated blood loss approaching 20% of estimated blood volume	163	42	277	33	0.002
Transfuse only if vital signs change, *e.g.*, blood pressure decreases or pulse rate increases significantly	58	15	443	52	< 0.001
If the patient is an adult, administer blood only if more than 1 U is required	70	18	98	12	0.002
Reconstitute or dilute erythrocytes*					
With crystalloid	268	69	745	87	< 0.001
With fresh frozen plasma	1	< 1	14	2	0.038
With albumin or other colloid	8	2	13	2	0.501
Use of micropore filters for erythrocyte transfusions*					
Rarely	128	33	160	19	< 0.001
If infusing more than 1 U	19	5	34	4	0.460
If infusing more than 2 U	93	24	59	7	< 0.001
For all transfusions	144	37	516	60	< 0.001
Use of blood warmers in the OR					< 0.001
None available	4	1	0		
For all transfusions	187	48	766	89	
Only if more than specified units are administered	148	38	52	6	
Other	50	13	41	5	

* Respondents could indicate more than one type.

OR = operating room.

lines, was added to the 2002 survey (question 10, Appendix 2). Fifty-five percent of respondents would transfuse platelets prophylactically in a patient with idiopathic thrombocytopenic purpura and a platelet count of 20×10^9/l, although the ASA Guidelines state that prophylactic platelet transfusion is ineffective and rarely indicated in patients with idiopathic thrombocytopenic purpura. Platelets would have been transfused by 51% of anesthesiologists in 2002 to patients with microvascular bleeding and platelet counts less than 100×10^9/l. Thirty-three percent would have transfused platelets to patients in whom one blood volume had been replaced. Only 12% would administer platelets prophylactically to patients with platelet counts between 50 and 100×10^9/l.

The 2002 survey had two questions related to fresh frozen plasma (FFP) administration (questions 11 and 12, Appendix 2). For question 11, the two most frequent responses were consistent with the ASA Guidelines: 83% administered FFP for urgent reversal of warfarin therapy, and 72% transfused patients with microvascular bleeding and prothrombin and activated partial thromboplastin times of 1.5 times normal. Only 6% of the respondents would transfuse patients with these laboratory values in the absence of clinical bleeding. When blood replacement exceeds 50–100% of estimated blood volume, 47% would transfuse FFP; 9% would transfuse FFP when blood replacement exceeds 25–50% of estimated blood volume. Forty-eight percent would administer FFP only on the basis of abnormal clotting studies. "None of the above" was chosen by 2%, and "other" was chosen by 6%.

When treating adult patients, 61% administered 2 U of FFP and checked prothrombin time and/or activated partial thromboplastin time; 16% transfused the same amount of FFP, but did not check the prothrombin time or activated partial thromboplastin time. Only 8% administered 10–15 ml/kg of FFP, which is the dose suggested in the ASA Guidelines. Seventy-eight percent would administer cryoprecipitate to a bleeding, massively transfused patient with a fibrinogen concentration less than 100 mg/dl, and 67% would administer cryoprecipitate to a patient with von Willebrand disease who was bleeding.

Use of Laboratory Testing in the OR

In 2002, hemoglobin or hematocrit was determined routinely (> 85% of the time) before transfusing erythrocytes in the OR by 55% of respondents, sometimes (6–85% of the time) by 34% of respondents, rarely (≤ 5% of the time) by 8% of respondents, and never by 3% of respondents. Of those who responded to the above question with routinely, sometimes or rarely

6% indicated that they would transfuse when hemoglobin was less than 10 g/dl (or hematocrit < 30%), 39% indicated that they would transfuse when hemoglobin was less than 8 g/dl (or hematocrit < 24%), and 6% indicated that they would transfuse when hemoglobin was less than 6 g/dl (or hematocrit < 18%). Forty-six percent indicated "other," with conditional responses being the rate of blood loss and anticipated continued blood loss, the medical condition and age of the patient, and the clinical picture and hemodynamic stability. Reasons cited for not determining the hemoglobin or hematocrit intraoperatively include the following: tests not available in the OR, laboratory too slow in returning results, and transfusion decisions not based on hemoglobin or hematocrit values.

The frequency of performing coagulation tests intraoperatively before transfusing platelets, FFP, or cryoprecipitate was reported as rarely (≤ 5% of the time) by 19%, sometimes (6–85% of the time) by 44%, and routinely (> 85% of the time) by 31%. The reasons for not performing the tests were as follows: tests not available in the OR; laboratory too slow; and long time required for blood components to be available, so they are ordered regardless of test results.

Usefulness of ASA Transfusion Education Materials

Seventy-three percent of the respondents were aware of the ASA brochure "Questions and Answers about Transfusion Practices." The information in the brochure was rated as somewhat useful by 55% of those aware of the brochure and very useful by 34%. Seventy-two percent of the respondents were aware of the ASA Practice Guidelines for Blood Component Therapy. The information was rated as somewhat useful by 55% of those aware of the guidelines and very useful by 36%.

Written Comments about Blood Transfusion Practices

Survey participants were offered the opportunity to provide written comments on blood transfusion practices. The primary problems in transfusion medicine identified by the respondents were as follows: overtransfusion (particularly by surgeons), delays in obtaining laboratory results and blood for transfusion in emergency situations, blood shortages, and complications of transfusion (*e.g.*, infectious disease and clerical errors).

Discussion

A large percentage of allogeneic blood is transfused in the OR. To improve perioperative blood administration practices, a better understanding of current transfusion practices and the perceived impediments to change is needed. The 2002 survey identified significant changes in transfusion practices since the original survey in 1981.[21] Although the responses presumably reflect individual anesthesiologists' behaviors in the clinical situations presented, they may not correctly reflect institutional practices. For example, 6% replied that their hospital does not have a transfusion committee, and 12% did not know whether one exists. The Joint Commission on Accreditation of Healthcare Organizations does not strictly require hospitals to have a transfusion committee or equivalent, but the Joint Commission on Accreditation of Healthcare Organizations does require an ongoing meaningful review of transfusion. In most hospitals, the transfusion committee performs this function.

Approximately half of the respondents did not know whether an MSBOS was used at their hospital, 27% said none was in use, and 20% indicated one was used. The percentage of hospitals using an MSBOS is unknown but is likely to be greater than 20%. Perhaps the respondents were not familiar with the term MSBOS.[22–24] The use of a type and screen is an integral component of an MSBOS. A large number of respondents expressed displeasure with the manner in which type and screen procedures were apparently used in their institutions, citing delays in obtaining blood when only a type and screen had been performed. It would seem that the systems are not working as they should and that some anesthesiologists are unfamiliar with the safety of administering uncrossmatched blood to patients with a negative antibody screen. Better communication between anesthesia departments and transfusion services might resolve many of these apparent problems.

In view of the large percentage of transfusions administered perioperatively, it is of interest that 62% of the anesthesiologists surveyed indicated that they never or rarely administer 3 or more units of blood to the same patient in a typical workweek, and 37% do so only one to five times a week. However, because many anesthesiologists are not involved in cases with large blood loss such as massive trauma, cardiac surgery, and liver transplantation,[10,23–26] this is not a surprising finding. The demographic characteristics of the respondents are similar to those of the ASA membership, suggesting that the survey participants were a representative random sample.

Despite reports of trends of decreasing numbers of blood donations and increasing numbers of blood transfusions[1] and blood shortages in many areas throughout the United States that result in elective surgical procedure delays, 96% of respondents in 2002 indicated that it was never or rarely necessary to cancel elective surgery because of unavailability of blood. Nevertheless, many of the anesthesiologists surveyed indicated that blood shortages are a major concern. Several expressed a desire to have whole blood available for transfusion, and 13% indicated that they do administer allogeneic whole blood.

Erythrocyte transfusion practices have improved since the 1981 survey. Fewer anesthesiologists (9%) still require patients to have a hemoglobin concentration of at least 10 g/dl before elective procedures than in 1981 (65%). No data are available for 1981 regarding the performance of intraoperative hemoglobin determinations, but the current responses indicate that 55% of anesthesiologists routinely (> 85% of the time) and 34% of anesthesiologists sometimes (6–85% of the time) perform hemoglobin or hematocrit determinations before intraoperative erythrocyte administration. Of those who use a "transfusion trigger," most (39%) transfuse when the hemoglobin is less than 8 g/dl. Six percent transfuse when the hemoglobin concentration is less 10 g/dl, and 6% do not administer erythrocytes until the hemoglobin concentration is less than 6 g/dl. A greater number (52%) rely on changes in vital signs (*i.e.*, decreased blood pressure, significant increases in pulse rate) when transfusing erythrocytes than in 1981 (15%). The use of lower transfusion triggers combined with clinical evaluation is consistent with the ASA Guidelines, as well as the recommendations of other organizations.[18,27,28]

Coagulation testing is performed routinely (> 85% of the time) by 31% or sometimes (6–85% of the time) by 44% of anesthesiologists before administration of platelets, FFP, or cryoprecipitate in the OR. The responses indicate that transfusion of these components is generally consistent with the ASA Guidelines. Exceptions are the prophylactic administration of platelets to patients with idiopathic thrombocytopenic purpura and infusion of volumes of FFP different from those recommended in the ASA Guidelines. Many respondents cited the lack of readily available coagulation testing in the OR as a problem. Although combining coagulation test results with clinical evaluation is optimal, a limitation to the widespread use of point-of-care coagulation testing is infrequent use. In addition, many of these tests have a different normal range than the hospital laboratory tests do, potentially confusing interpretation of test results. Few of the responding anesthesiologists transfused large volumes of blood on a regular basis. Thus, point-of-care coagulation testing might rarely be used, bringing its cost effectiveness into question.

Autologous transfusion practices have changed. In 1981, only 49% of respondents indicated that a mechanism was established in their hospitals for patients to predonate blood for elective surgery. The same question was not repeated on the 2002 survey, but it is assumed that predonation is more widely available as a result of current requirements that patients undergoing elective surgery be offered alternatives to allogeneic transfusion. When predonated autologous blood is available, 61% use the same criteria for transfusion as for allogeneic blood, whereas 39% administer autologous blood more liberally. Although controversial, the ASA Guidelines support the latter practice. Ninety-five percent of respondents indicated that equipment is currently available for intraoperative autologous transfusion, whereas only 38% had such equipment for intraoperative blood salvage and reinfusion in 1981. The frequency of use of acute normovolemic hemodilution is unknown. However, the percentage of respondents indicating that they had used acute normovolemic hemodilution was 22% in 1981, and 31% of respondents to the 2002 survey indicated that they had used the technique within the previous 12 months.

There are multiple possible limitations to our study. Surveys measure people's perceptions and not necessarily reality. Respondents also may give responses that they consider correct or expected rather than indicating their actual practices. Because this survey was sponsored by the ASA, it is possible that respondents may have given answers consistent with ASA publications, rather than their actual behavior. It is of interest that the necessity to cancel elective surgery because of nonavailability of blood has decreased since 1981, although many of the anesthesiologists surveyed indicated that blood shortages were a major concern. As with all surveys, the data derived are only as good as the survey instrument and the sampling of the population. Our survey instrument was a modification of a previous survey to allow comparisons with the previous survey, and every effort was made to make it a valid survey tool. A randomization process was used to obtain a random sample of active ASA members. There is bias in our study population because only active members of the ASA were surveyed and a large percentage of academic anesthesiologists responded. Finally, the results of the survey only reflect the impressions of those who returned the survey, which was 41%. This response rate is similar to other national surveys of medical professional organization members.[29,30] We have no means of identifying and eliciting the responses of the anesthesiologists who chose not to respond to the survey.

In summary, significant changes in transfusion practices among anesthesiologists have occurred since 1981. Several organizations, including the ASA, promulgated transfusion guidelines during that time. Most anesthesiologists (72%) are familiar with the ASA Guidelines. Of those who are familiar with the guidelines, 55% find them somewhat useful, and 36% find them very useful. It would seem from the responses to the questions about platelet, FFP, and cryoprecipitate administration that the ASA Guidelines are, in general, being followed. The majority of anesthesiologists also seem to transfuse allogeneic and autologous erythrocytes in a manner consistent with the ASA Guidelines. The primary problems in transfusion medicine identified by the respondents were overtransfusion (particularly by surgeons), delays in obtaining laboratory results and blood for transfusion in emergency situations, blood shortages, and complications of transfusion (*e.g.*, infectious disease and clerical

errors). Several issues (*e.g.*, platelet administration to patients with idiopathic thrombocytopenic purpura and preoperative blood ordering procedures) were identified that warrant further educational endeavors and improved interaction with local transfusion services.

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Appendix 1: 2002 American Society of Anesthesiologists Committee on Transfusion Medicine

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Appendix 2: Survey of Active ASA Members Conducted in 2002 by the ASA Committee on Transfusion Medicine

AMERICAN SOCIETY OF ANESTHESIOLOGISTS

1. If you do not provide or directly supervise anesthesia for patients who require transfusion (e.g., do only ambulatory anesthesia or pain medicine), please indicate so by filling in the bubble below and return the survey. Thank you.
❒

2. How many times in a typical work week do you transfuse 3 or more units of blood to the same patient?

❒ Rarely or never
❒ 1 to 5 times a week
❒ 6 to 10 times a week
❒ 11 or more times a week

3. Who is primarily responsible for ordering and administering blood products intraoperatively?

❒ Anesthesiologist only
❒ Surgeon only
❒ Joint responsibility

4. Do you require your patients who are undergoing elective surgery to have a hemoglobin concentration of at least 10 g/dL?

❒ No ❒ Yes

5. Assume for each of the patients described below that the surgery is necessary and it should be performed within 48 hours. Which of the following would you do? (Mark the boxes for all things you would do.)

Case Description	I would transfuse preoperatively ▼	I would administer general anesthesia without requiring blood availability ▼	I would require a type and screen prior to surgery ▼	I would require blood to be crossmatched prior to surgery ▼
A. Healthy, 3-month-old for hernia repair, Hgb 9.2 g/dL.....	❒	❒	❒	❒
B. 15-year-old male with sickle cell anemia for arthroscopy of the knee, Hgb 7.5 g/dL.....	❒	❒	❒	❒
C. 38-year-old female with menometrorrhagia for D&C, Hgb 8.5 g/dL.....	❒	❒	❒	❒
D. 45-year-old male with endstage renal disease for creation of arteriovenous fistula in the groin, Hgb 6 g/dL.....	❒	❒	❒	❒

6. How frequently do you perform hemoglobin or hematocrit determinations prior to transfusing red blood cells in the operating room?

❒ Never ▼ ❒ Rarely (5% or less of time) ▼ ❒ Sometimes (6 to 85% of time) ▼ ❒ Routinely (more than 85% of time) ▼

If you use hemoglobin (or hematocrit), what "transfusion trigger" do you use?

❒ Transfuse when hemoglobin less than 10 g/dL (or hematocrit < 30%)
❒ Transfuse when hemoglobin less than 8 g/dL (or hematocrit < 24%)
❒ Transfuse when hemoglobin less than 6 g/dL (or hematocrit < 18%)
❒ Other, please specify:_____

If not done, why not? (Mark all that apply.)

❒ Tests not available in the OR
❒ Laboratory too slow to return results
❒ Transfusion decisions are not based on hemoglobin or hematocrit values
❒ Other, please specify:_____

7. For operative procedures that do not always require red blood cell replacement, which of the following best describes your usual approach for transfusion of red blood cells? (Mark all that apply.)

❒ Transfuse when blood loss approximates 10% of estimated blood volume
❒ Transfuse prior to estimated blood loss approaching 20% of estimated blood volume
❒ Transfuse only if vital signs change, e.g., blood pressure decreases or pulse rate increases significantly
❒ If the patient is an adult, administer blood only if more than one unit is required
❒ Other, please specify:_____

8. How frequently do you perform coagulation tests intraoperatively prior to transfusing platelets, FFP, or cryoprecipitate in the operating room?

❒ Never ▼ ❒ Rarely (5% or less of time) ❒ Sometimes (6 to 85% of time) ❒ Routinely (more than 85% of time)

If not done, why not? (Mark all that apply.)

❒ Tests not available in the OR
❒ Laboratory too slow to return results
❒ A long period of time is required for blood to be available; therefore, the components are ordered regardless of coagulation test results
❒ Other, please specify:_____

If you use coagulation tests prior to transfusing platelets, FFP, or cryoprecipitate in the operating room, what tests do you use?

_____

9. For which of the following circumstances do you request that platelets be available? (Mark all that apply.)

❒ History of ingestion of aspirin or other platelet-inhibiting drugs
❒ If greater than one blood volume replacement anticipated
❒ Platelet count below (specify)_____ x 10^9/L with significant anticipated blood loss
❒ Surgical procedures usually associated with large blood loss (specify:_____)

10. Under which of the following circumstances do you administer platelet transfusions? (Mark all that apply.)

❒ Prophylactically in a patient with idiopathic thrombocytopenia purpura and platelet count of 20 x 10^9/L
❒ Prophylactically in a patient with platelet count between 50 x 10^9/L and 100 x 10^9/L
❒ Prophylactically in a patient in whom one blood volume has been replaced
❒ Microvascular bleeding in a patient with a platelet count less than 100 x 10^9/L
❒ None of the above

11. Under which of the following circumstances do you administer fresh frozen plasma? (Mark all that apply.)

❒ When blood replacement exceeds 25 to 50% of estimated blood volume
❒ When blood replacement exceeds 50 to 100% of estimated blood volume
❒ When urgent reversal of warfarin therapy is required
❒ When microvascular bleeding occurs in a patient with PT or aPTT of 1.5 times normal
❒ If PT or aPTT are more than 1.5 times normal, even if patient is not bleeding
❒ None of the above

12. When you administer fresh frozen plasma to an adult, which of the following best describes your usual practice? (Mark only one.)

❒ Administer 2 units FFP without checking PT or aPTT
❒ Administer 2 units FFP and check PT and/or aPTT
❒ Administer 10-15 mL/kg of FFP
❒ Administer 4 units FFP
❒ Other, please specify:_____

13. Under which of the following circumstances do you administer cryoprecipitate? (Mark all that apply.)

❒ Prophylactically in a non-bleeding patient with von Willebrand's disease after DDAVP therapy
❒ Prophylactically in a non-bleeding patient with fibrinogen deficiency
❒ Bleeding in a patient with von Willebrand's disease
❒ Bleeding in a massively transfused patient with a fibrinogen concentration < 100 mg/dL
❒ None of the above

14. Which of the following best describes your use of blood warmers in the OR? (Mark only one.)

❒ None available
❒ Use warmer for all red blood cell transfusions
❒ Use warmer only if more than (specify)_____ units are administered
❒ Other, please specify:_____

15. Which statement(s) best describes your use of micropore filters for red blood cell transfusions? (Mark all that apply.)

❒ Never use
❒ Use rarely
❒ Use if infusing more than one unit of RBCs
❒ Use if infusing more than two units of RBCs
❒ Use for all RBC transfusions
❒ Other, please specify:_____

16. When patients have predonated autologous blood, which describes your usual practice for reinfusing the autologous blood?

❒ Administer intraoperatively, regardless of blood loss
❒ Use the same criteria as I do for allogeneic transfusion
❒ Administer more liberally than allogeneic blood
❒ Other, please specify:_____

17. In the past 12 months, have you ever employed acute normovolemic hemodilution (i.e., withdraw blood immediately prior to surgery and reinfuse it later in the procedure)?

❒ No ❒ Yes

18. In your hospital, is any type of apparatus used for intraoperative salvage and reinfusion of blood?

❒ No ❒ Yes ❒ Don't know

19. Do you utilize a maximum surgical blood-ordering schedule in your primary hospital?

❒ No ❒ Yes ❒ Don't know

20. Is a type and screen routinely done prior to surgical procedures for which blood may be required but is usually not crossmatched?

❒ No ❒ Yes ❒ Don't know

21. How often is it necessary to cancel elective surgery due to non-availability of blood products? (Mark only one.)

❒ Never
❒ Rarely (1% or less of time)
❒ Sometimes (2% to 5% of time)
❒ Frequently (more than 5% of time)

22. How available are platelets for intraoperative transfusion? (Mark only one.)

❒ Never available unless arrangements made preoperatively
❒ Sometimes available
❒ Usually available
❒ Always available

23. Which methods for estimating blood loss do you usually employ during major intra-abdominal surgery in adults? (Mark all applicable.)

❒ Not applicable – do not do these procedures
❒ Visual estimation
❒ Measuring contents of suction containers
❒ Weighing sponges
❒ Serial hematocrit and/or hemoglobin determinations
❒ Other, please specify:_____

24. Do you ever administer allogeneic *whole* blood?

❒ No ❒ Yes

25. How do you reconstitute or dilute red blood cells? (Mark all that apply.)

❒ Not applicable - do not reconstitute (or dilute) red blood cells
❒ With crystalloid (specify type):_____
❒ With fresh frozen plasma
❒ With albumin or other colloid

26. Does your hospital have a transfusion committee?

❒ No ❒ Yes ▼ ❒ Don't know

If yes, is there an anesthesiologist on the committee?

❒ No ❒ Yes ❒ Don't know

27. Are you aware of the ASA brochure *"Questions and Answers about Transfusion Practices"*?

❒ No ❒ Yes ▼

How useful has this information been for you?

❒ Of little or no use ❒ Somewhat useful ❒ Very useful

28. Are you aware of the ASA *"Practice Guidelines for Blood Component Therapy"*?

❒ No ❒ Yes ▼

How useful has this information been for you?

❒ Of little or no use ❒ Somewhat useful ❒ Very useful

29. List what you consider to be the major problems in transfusion practices today.

30. We welcome any additional comments on blood transfusion practices.

About You

31. How many years have you been practicing anesthesiology?

❒ 5 or less years
❒ 6 to 10 years
❒ 11 to 15 years
❒ 16 to 20 years
❒ 21 or more years

32. You are certified by: (Mark all that apply.)

❒ American Board of Anesthesiology
❒ American Osteopathic Board of Anesthesiology
❒ American College of Anesthesiologists
❒ American Osteopathic College of Anesthesiologists
❒ Other, please specify:_____

33. The majority of your anesthesia cases are:

❒ Obstetric
❒ Pediatric
❒ Cardiac
❒ Neurosurgical
❒ Other, please specify:_____
❒ Combination of the above

34. How many beds does your primary hospital have?

❒ 100 or less
❒ 101 to 250
❒ 251 to 500
❒ 501 to 1,000
❒ Over 1,000

35. What is the population of your practice location?

❒ Less than 10,000
❒ 10,000 to 50,000
❒ 50,001 to 100,000
❒ 100,001 to 500,000
❒ More than 500,000

36. What best describes your type of anesthesia practice?

❒ Academic
❒ Private practice
❒ Other, please specify:_____

Thank you for completing this survey!