



Classification of Complications Associated with Hemodialysis Vascular Access Procedures

A Position Statement from the American Society of Diagnostic and Interventional Nephrology

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ABSTRACT

A procedure-related complication is an unanticipated adverse event that requires therapy. In order to analyze frequency and severity of complications in the process of quality assurance, it is useful to have a classification of complications, indicating the type and severity. The Clinical Practice Committee of American Society of Diagnostic and Interventional Nephrology has developed a Classification of Complications relating to

Hemodialysis Vascular Access Procedures, based on the system first proposed by Beathard in 2006. In this system, the "type" refers to the procedure being performed or vessel entered, and the "grade" is based on the intensity of medical care needed to address the complication. This publication describes 10 Types and 4 Grades of complications.

A quality assurance program is an increasingly desirable and important component of all health care practices. The objective of such a program is to document and assess clinical outcomes using parameters that are appropriate for the clinical specialty.

A goal of the American Society of Diagnostic and Interventional Nephrology (ASDIN) is to develop and encourage the implementation of a quality assurance program which is relevant to a broad range of vascular access procedures. An important component of a quality assurance program is the documentation and subsequent analysis of procedure-related complications (PRC). This information is needed to assess physician performance and to provide an analytical tool for procedural improvement. Two different systems for reporting PRC have been created; one by the Society of Interventional Radiology (SIR) and another by the Society of Vascular Surgery (SVS) (1,2).

The SIR has recommended a general classification scheme which can be utilized for the assessment and documentation of many different types of procedural-related complications (1,3). However, this simplified classification scheme utilizes broadly defined criteria which allow subjective interpretation when grading the severity of a complication. Leoni et al. (4) performed a prospective survey of interventional radiologists to determine the reproducibility of results when using the SIR classification scheme. These investigators discov-

ered that there is substantial variability in the interpretation and grading of complications when physicians use the SIR classification scheme. Leoni et al. (4) concluded that "current criteria for reporting complications are associated with moderate rates of disagreement among interventional radiologists." The SIR has also published recommended threshold values for complications associated with hemodialysis vascular access procedures (5). Unfortunately, these threshold values are based upon retrospective data gathered from suboptimal studies and do not necessarily represent current clinical practices.

In 2002, the Committee on Reporting Standards of the SVS and the American Association for Vascular Surgery published recommendations for grading and reporting of complications associated with hemodialysis vascular access (2). The SVS classification scheme provides qualitative descriptors to grade the severity of vascular access-related complications. This represents an improvement over the generic SIR classification scheme. However, the SVS scheme is primarily structured to assess complications associated with surgical procedures. Although some components of the SVS classification scheme are relevant to percutaneous procedures, it does not include specific criteria for the assessment of angioplasty-related or stent-related complications.

Beathard et al. (6) recently proposed a new scheme to categorically grade complications associated with percutaneous vascular access procedures. This "PRC" system provides descriptive criteria which are specific to percutaneous procedures. The PRC classification system includes a broad range of complications including device-related and drug-related complications.

However, these classification systems are inadequate for documenting the many types of procedural compli-

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cations that can occur. For example, the other classification schemes do not include criteria for grading the unique complications which are associated with central venous catheters or endovascular stents.

To better define and grade the many types of complications which can occur during percutaneous vascular access procedures the ASDIN Clinical Practice Committee has developed a new comprehensive classification scheme. With this scheme the complication is first categorized by the type of event and then the severity of the complication is graded using type-specific criteria. The grade is determined by the level of treatment that is required to successfully manage the complication or the severity of any resulting adverse sequelae. This ASDIN classification scheme has been developed to improve the documentation of procedural related complications and hopefully it will prove to be a useful analytical tool.

PRC

A procedural related complication is defined as an unanticipated adverse event that requires therapy. In general, unanticipated events that do not require therapy are not considered complications. It should be noted that in most instances a failed procedure should not be considered a complication. An inability to reestablish functionality (i.e., adequate blood flow) leading to permanent loss of a vascular access does not constitute a complication unless the procedural failure is due to an unanticipated event (i.e., rupture).

The intent of this grading system is to document unanticipated events which are the direct result of a percutaneous procedure. Complications which occur during or immediately after a procedure should, in most instances, be attributed to the procedure. Subacute complications, which occur days or weeks following a procedure, may not be a direct result of the percutaneous intervention and therefore may not represent a procedural related complication. This is in contradistinction to surgical classification schemes in which all adverse events occurring within 30 days are considered to be postoperative complications (2). Although the ASDIN classification scheme is not intended to include complications which are not directly related to a percutaneous procedure, local institutions or state regulations may require the physician to document all unanticipated events that occur during the 30-day postoperative period.

It is acknowledged that some procedure-related events do not warrant documentation. An unanticipated event may be recognized by the operating physician but if no treatment is administered and there is no effect on the outcome of the procedure then the event should not be recorded. For example, a malpositioned central venous catheter tip which is immediately recognized and repositioned into the desired location should not be documented as a complication. Another example is the recognition of a small amount of extravasation following a balloon angioplasty procedure. If there is no effect on blood flow, balloon tamponade is not performed, and there are no long-term sequelae, then the event need

not be documented. The purist may want to categorize such an event as a complication but this would unnecessarily burden the physician and provide minimal clinical value. It is recommended that only those procedure-related events that undergo treatment, even minimal treatment, or result in an adverse sequelae should be graded and documented.

Classification and Grading of Complications

Types of Complications

The ASDIN classification system was created to grade complications which are specifically associated with vascular access procedures. This classification scheme recognizes 10 types of complications that may occur when performing percutaneous procedures for management of autogenous or prosthetic arteriovenous access, and during the insertion of central venous catheters and ports (Table 1). This list is not intended to be comprehensive and it is acknowledged that other types of complications may occur.

General Grading of Complications

A general grading scale, similar to the SIR classification scheme, is provided in Table 2. This grading scale can be utilized to grade the severity of a broad range of complications including those not listed in Table 1. The severity of the complication increases from grade 1 to grade 4. When criteria are too general they become subjective and rely upon physician judgment when grading a complication. And as reported by Leoni et al. (4), the

TABLE 1. Types of complications

Type I	Access site hematoma
Type II	Vascular rupture
Type III	Arterial complications
Type IV	Stent-related complications
Type V	Catheter insertion complications
Type VI	Adverse reactions to medications
Type VII	Oxygen saturation and apnea
Type VIII	Hypotension/hypertension
Type IX	Cardiac arrhythmia
Type X	Clinical status

TABLE 2. General grading scheme

Grade 1	Nominal therapy required Unplanned increase in level of care to a nominal degree No clinical consequence or adverse sequelae
Grade 2	Minor therapy required Successful management using percutaneous therapy No significant long-term sequelae
Grade 3	Major therapy required Persistent or unstable complication Surgical repair is required Hospitalization for observation or management of a complication
Grade 4	Significant long-term (> 30 days) sequelae loss of limb or significant loss of limb function

use of such subjective criteria can lead to substantial interobserver variability and thereby decrease the usefulness of the classification system. For this reason the ASDIN classification scheme was created to provide type-specific criteria for grading PRC.

Type-Specific Grading of Complications

A type-specific grading scheme has been developed to better define and qualify the severity of a procedural related complication. The intent is to improve the reproducibility of the grading system and thereby provide a useful analytical tool for assessing procedure outcomes. As previously described, the grading of a complication is determined by the level of treatment that is required to successfully manage the event or the severity of any resulting adverse sequelae. If several different treatments are performed the grade of the complication should be based upon the criterion with the highest grade. For example, if percutaneous therapy (balloon tamponade) was used to repair an acute vascular rupture (type II), but the patient required hospital admission for a blood transfusion, the complication should be documented as grade 3 (see Table 4).

Although the specific grading criteria are different for each type of complication, there is uniformity throughout the entire classification system. For example, if percutaneous therapy is required for successful management of a complication then it should always be documented as grade 2. If surgical repair is required then the complication should always be documented as grade 3. If hospitalization is required for treatment of a complication then it should be grade 3. In all instances, if death results from the complication it should receive a grade 4. This general scheme can be used for the broad range of complications that may occur.

Also included is a clinical status numerical scoring system for assessment of preprocedure and postprocedure clinical status. It must be recognized that the clinical judgment of when to do a procedure and when not to do a procedure is an important responsibility of the interventional physician. If the clinical status of the patient deteriorates because of the underlying comorbid conditions relevant to the patient but not the procedure itself, then this would not be reflected in any of the procedure-related tables. For this reason it is recommended that this scoring system be utilized to demonstrate that the clinical status of the patient postprocedure is at least as good as it was preprocedure.

Type I: Access Site Hematoma

An access site hematoma is classified as a procedural-related complication if it develops during the procedure or within 24 hours following the procedure. The specific location of the hematoma should be documented when reporting the complication. It is important to differentiate between complications from punctures made at the time of the procedure versus sequelae from punctures made at the dialysis facility. The criteria for grading a hematoma that develops at a vascular access entry (puncture) site is described in Table 3.

TABLE 3. Access site hematoma

Grade 1	Nominal therapy required
	1. Warm compresses or similar therapy for symptoms
	2. Drug reversal agent (i.e., Protamine) is administered
Grade 2	Minor therapy required
	1. Percutaneous therapy is required to stop hemorrhage
	(a) Balloon tamponade
	(b) Stent or stent graft placement
Grade 3	Major therapy required
	1. Surgical repair or drainage required
	2. Blood loss necessitates transfusion
	3. Hospitalization for observation or continued therapy
Grade 4	Permanent loss of vascular access
	Permanent impairment

Type II: Vascular Rupture

A vascular rupture may occur during an angioplasty procedure or by inadvertent passage of a guidewire, catheter, or other endovascular device through the vascular wall. A vascular rupture is identified by angiography as extravasation of x-ray contrast material into the perivascular tissue. A rupture may be self-limited with minimal perivascular hemorrhage, no clinical evidence (hematoma), and no alteration in blood flow. A major rupture can cause persistent hemorrhage, the development of a perivascular hematoma, extrinsic compression of the adjacent vascular structures, and decreased blood flow through the vascular access. Criteria for grading complications associated with vascular rupture are provided in Table 4.

Type III: Arterial Complications

Although uncommon, an arterial complication may occur during any percutaneous vascular access procedure. Because of the higher intravascular pressure, an arterial complication is often more troublesome than a similar venous complication. An inadvertent arterial

TABLE 4. Vascular rupture

Grade 1	Nominal therapy required
	1. Localized extravasation of contrast
	2. Self-limited, stable hematoma
	(a) No alteration in blood flow through vascular access
Grade 2	Minor therapy required
	1. Hemorrhage controlled by percutaneous therapy
	(a) Balloon tamponade
	(b) Insertion of stent or stent graft
	2. Hematoma causing reduction in blood flow
Grade 3	Major therapy required
	1. Persistent hemorrhage requiring therapy
	(a) Surgery
	(b) Blood transfusion
	2. Unstable (expanding) hematoma
	3. Thrombosis of vascular access (spontaneous or intentional)
	4. Hospitalization for observation or continued therapy
Grade 4	Permanent loss of vascular access
	Permanent impairment

TABLE 5. Arterial complications

Grade 1
Nominal therapy required
1. Inadvertent cannulation of an artery with no sequelae
2. Arterial air embolus with no sequelae
Grade 2
Minor therapy
1. Percutaneous embolectomy required
2. Arterial injury successfully treated with balloon tamponade
3. Arterial injury successfully treated with stent or stent graft
Grade 3
Major therapy required
1. Surgical thrombectomy required
2. Surgical repair of artery required
3. Hospitalization for observation or continued therapy
Grade 4
Permanent loss of vascular access
Permanent impairment

puncture can quickly blossom into a large, compressive hematoma if it is not recognized and managed appropriately. Similarly, even a small arterial embolus, either thrombus or air, can incite a cascade of complications if it is not identified and swiftly removed. A major arterial complication, such as an acute rupture, often requires urgent surgical intervention. However, the availability of small-diameter stent grafts has improved our ability to percutaneously repair some acute arterial injuries. Criteria for grading arterial complications are provided in Table 5.

Type IV: Stent-Related Complications

Metallic stents and polytetrafluoroethylene-stent grafts have become increasingly utilized for percutaneous management of angioplasty-induced complications such as venous dissection and venous rupture. These endovascular devices are also useful for improving luminal diameter of central venous lesions which exhibit elastic recoil or quickly recur following angioplasty. Optimal deployment of a stent or stent graft requires selection of a device with the appropriate characteristics and optimal dimensions. Insertion of an undersized device may lead to stent malposition or migration and suboptimal coverage of the lesion. Insertion of an oversized stent graft can result in endoluminal folding of graft material thereby causing obstruction of blood flow. Rigid stents can become deformed or crush when used in peripheral veins. Deployment of a stent or stent graft can become complicated by physician error or device malfunction. In the event of a major complication, emergent surgery may be necessary to remove the stent or stent deployment system. Criteria for grading complications associated with insertion of stent or stent grafts are provided in Table 6.

Type V: Catheter-Insertion Complications

The intent of this grading scheme is to document complications which are directly attributable to the catheter insertion procedure. These include all unexpected events that occur during or immediately after a procedure. Subacute complications which occur during the days that follow a procedure should be included if the event can be

TABLE 6. Stent-related complications

Grade 1
Nominal therapy required
1. Stent malposition not requiring second stent
Grade 2
Minor therapy required
1. Malposition requiring second stent
2. Stent migration requiring second stent
(a) Migrated stent in stable, benign position
Grade 3
Major therapy required
1. Stent migration requiring retrieval
2. Acute thrombosis of stent
3. Urgent surgery required for stent removal
4. Hospitalization observation or continued therapy
Grade 4
Permanent loss of vascular access
Permanent impairment

directly related to the catheter insertion procedure. Long-term complications of vascular access devices, such as catheter dysfunction, venous stenosis, and venous thrombosis are not addressed in this grading scheme. Criteria for grading catheter insertion-related complications are provided in Table 7.

Type VI: Adverse Reactions to Medications

Patients may experience an adverse reaction to intravascular radiographic contrast media or medications administered for conscious sedation. Adverse reactions typically occur soon after administration of the drug, although significant reactions may occur several hours after completion of the procedure. Criteria for grading adverse reactions to medications are described in Table 8.

Type VII: Respiratory Depression

A reduction in a patient's respiratory rate, respiratory volume, or oxygen saturation level is often the result of medications administered for conscious sedation. In patients with chronic renal failure, fluid overload and pulmonary edema may be a primary or secondary contributing factor. Grading of type VII complications is determined by the patient's oxygen saturation level as measured using pulse oximetry (Table 9).

Type VIII: Hypotension/Hypertension

Patients with chronic renal failure may experience acute fluctuations in their systemic blood pressure. Although these changes may be the result of medications administered for conscious sedation, other potential contributing factors include fluid overload, failure to take oral antihypertensive medication, and underlying cardiac functional abnormalities. Because of preprocedural nil per os orders, patients sometimes fail to take their antihypertensive medication. Such failure may lead to an elevated blood pressure requiring treatment before or during the procedure. These should not be considered nor classified as a procedural related complication. Criteria for grading blood pressure-related events are provided in Table 10.

TABLE 7. Catheter insertion complications

Grade 1
Nominal therapy required
1. Prolonged bleeding requiring nominal therapy (i.e., pressure dressing, suture, or cauterization of tract/exit site)
2. Inadvertent needle puncture of an artery or vein without sequelae
3. Small hematoma (< 3 cm)
Grade 2
Minor therapy required
1. Mechanical problem secondary to insertion error (i.e., kinking, malposition) requiring return to procedure room for correction
2. Prolonged bleeding requiring medical therapy (i.e., DDAVP, protamine)
3. Inadvertent insertion of a catheter, sheath, or dilator into an artery without sequelae
4. Large hematoma (> 3 cm)
5. Exit site infection attributable to insertion procedure
6. Vascular injury resolved with percutaneous therapy without sequelae
7. Asymptomatic air embolus
Grade 3
Major therapy required
1. Bleeding complication requiring surgical intervention
2. Embolization of a catheter, guidewire, or other component utilized during insertion procedure
3. Tunnel infection attributable to insertion procedure
4. Catheter-related infection requiring antibiotics or catheter removal attributable to the insertion procedure
5. Symptomatic venous thrombosis or phlebitis attributable to the catheter insertion procedure requiring anticoagulation therapy or catheter removal
6. Symptomatic air embolus with resolution
7. Pneumothorax requiring intervention
8. Hospitalization observation or continued therapy
Grade 4
Life-saving surgery or permanent impairment
1. Thoracotomy or laparotomy (femoral catheter) required for vessel repair
2. Cardiac perforation or pericardial tamponade

TABLE 8. Adverse reactions to medications

Grade 1
Nominal/medication oral or intravenous therapy required
1. Nausea and vomiting
2. Prolonged (> 30 minutes) pruritus requiring therapy
3. Regional urticaria
Grade 2
Minor therapy required
1. Brief loss of consciousness
2. Prolonged vomiting
3. Self-limited dyspnea
4. Seizure with rapid resolution
5. Mild bronchospasm resolved with therapy
6. Chest pain resolved with therapy
7. Hospitalization for observation
Grade 3
Major therapy required
1. Hospitalization for observation or continued therapy
Grade 4
Respiratory or cardiac arrest
Permanent alteration in cognitive or functional capacity

Type IX: Cardiac Arrhythmia

Patients with chronic renal failure often have underlying cardiac disorders. Malfunction or occlusion of a vascular access, and inability to undergo hemodialysis

TABLE 9. Respiratory complications

Grade 1
Nominal therapy required
1. Change in oxygen saturation that requires nominal therapy and improves (O ₂ sat > 90%) with supplemental oxygen, or patient repositioning
Grade 2
Minor therapy required
1. Prolonged (> 30 seconds) decrease in O ₂ saturation (< 90%) which improves with minor therapy
(a) Use of nonrebreather mask
(b) Reversal of sedation/analgesia
Grade 3
Major therapy required
1. Insertion of oral airway, LMA, or intubation
2. Hospitalization observation or continued therapy
Grade 4
1. Respiratory or cardiac arrest
2. Permanent impairment secondary to respiratory depression

TABLE 10. Hypotension and hypertension

Grade 1
Nominal therapy required
1. A change in blood pressure which requires nominal therapy
(a) Change in patient position
(b) Change in IV infusion rate
Grade 2
Minor therapy required
1. A change in blood pressure which requires minor therapy
(a) Fluid bolus
(b) Administration of blood pressure medication
(c) Reversal of sedation/analgesia
Grade 3
Major therapy required
1. A persistent change in blood pressure which does not improve with minor therapy
2. Administration of medications via IV drip infusion
3. Hospitalization for observation or continued therapy
Grade 4
1. Cardiac resuscitation
2. Permanent impairment of cognitive function

treatment, can lead to electrolyte abnormalities and fluid overload. These conditions may exacerbate pre-existing cardiac problems and elicit an acute cardiac arrhythmia. Procedural-related events can be primary or secondary contributing factors for cardiac arrhythmia. These events include: (1) adverse reactions to medications administered for conscious sedation, (2) procedural blood loss, (3) iatrogenic pulmonary embolism, and (4) unrecognized placement of wires or catheters into the heart. Criteria for grading cardiac arrhythmia are provided in Table 11.

Type X: Clinical Status

While timely discharge of the dialysis patient is important in view of the demands of the dialysis schedule, discharge must be safe for the patient. Pre-existing medical conditions can increase the complexity of a percutaneous procedure. Failure to recognize or suboptimal management of a comorbid condition may lead to a deterioration of a patient's clinical state; this represents a procedural related complication. It is very likely that such changes would not be reflected in the other types of

TABLE 11. Cardiac arrhythmia

Grade 1
Nominal therapy required
1. Transient (< 5 minutes) abnormal cardiac rhythm which resolves with nominal therapy
(a) Supplemental oxygen
(b) Correction of blood pressure alterations
Grade 2
Minor therapy required
1. Prolonged (> 5 minutes) abnormal cardiac rhythm which resolves with minor therapy
(a) Antiarrhythmia medication
(b) Reversal of sedation/analgesia
Grade 3
Major therapy required
1. Sustained abnormal cardiac rhythm which does not resolve with minor therapy
2. Administration of medications via continuous IV drip infusion
3. Cardioversion
4. Hospitalization for observation or continued therapy
Grade 4
Cardiac resuscitation

procedural related complication related above. For this reason a Clinical Status Scoring System has been created to assess and grade the patient's physiologic parameters. Using this system one arrives at a General Clinical Status score (GCS score). This system is intended to evaluate changes in the general clinical status of the patient not directly related to the procedure itself but to the overall condition of the patient. The derived score should serve as an indicator of any changes that might have occurred. The GCS score would be used in the same manner as the Aldrete score that has been used to evaluate the recovery from anesthesia for more than 30 years and the postanesthesia discharge scoring system score that has been recommended more recently for determining readiness for discharge following ambulatory surgery (7,8).

Hemodialysis patients who present to the interventional facility for a procedure are often complex with multiple comorbidities and significant disabilities. It is important that we replace or at least supplement the usual qualitative, subjective method for evaluating such patients for discharge with a quantitative, objective technique to provide a simple and consistent method of determining home readiness. Use of the GCS Scoring system does this. It is easily applied and easily remembered. In addition to permitting a uniform assessment of home readiness for patients, the GCS system establishes a pattern of routine, repetitive evaluation of the patient's condition that is likely to contribute to improved patient outcome. In this way, it may also have added medicolegal value.

For the GCS Scoring system to be effective the patient must be evaluated prior to the procedure to establish a baseline. Then the patient should be reevaluated and scored prior to discharge to determine home readiness. If any deterioration has occurred, action is indicated. The GCS score should be the same following the procedure as the baseline value determined prior to the procedure. The action taken may range from additional recovery time to an emergency hospital admission. Criteria for grading the action taken are listed in Tables 12 and 13.

TABLE 12. General clinical status

Grade 1
Nominal deterioration of NSS score
1. Patient required prolonged observation period but returned to baseline
Grade 2
Minor deterioration of NSS score
1. Patient required minor therapy but returned to baseline
Grade 3
Major deterioration of NSS score
1. Patient did not return to baseline. Required hospital admission
Grade 4
Death initiated by initial deterioration of NSS score during the procedure

TABLE 13. Clinical status score

Criterion	Score
Consciousness	
Awake or at baseline	2
Responding to stimuli	1
Not responding	0
Airway	
Coughing on command or at baseline	2
Maintaining good airway	1
Airway requires maintenance	0
Oxygen saturation	
92% or greater, or at baseline or better	2
Oxygen saturation at 90% or greater on supplemental oxygen	1
Oxygen saturation < 90% on supplemental oxygen	0
Movement	
Moving purposefully or at baseline	2
Nonpurposeful movements	1
Not moving	0
Ambulation	
Ambulate unassisted or at baseline	2
Ambulate only with assistance	1
Unable to ambulate	0
Total score	

References

- Sacks D, McClenny TE, Cardella JF, Lewis CA: Society of interventional radiology clinical practice guidelines. *J Vasc Interv Radiol* 14:S199-S202, 2003
- Sidaway AN, Gray R, Besarab A, Henry M, Ascher E, Silva M, Miller A, Scher L, Trerotola S, Gregory RT, Rutherford RB, Kent KC: Recommended standards for reports dealing with arteriovenous hemodialysis access. *J Vasc Surg* 35:603-610, 2002
- Gray RJ, Sacks D, Martin LG, Trerotola SO, Members of the Society of Interventional Radiology Technology Assessment Committee: Reporting standards for percutaneous interventions in dialysis access. *J Vasc Interv Radiol* 14:S433-S442, 2003
- Leoni CJ, Potter JE, Rosen MP, Brophy DP, Lang EV: Classifying complications of interventional procedures: a survey of practicing radiologists. *J Vasc Interv Radiol* 12:55-59, 2001
- Aruny JE, Lewis CA, Cardella JF, Cole PE, Davis A, Drooz AT, Grassi CJ, Gray RJ, Husted JW, Jones MT, McCowan TC, Meranze SG, Van Moore A, Neithamer CD, Oglevie SB, Omary RA, Patel NH, Rholl KS, Roberts AC, Sacks D, Sanchez O, Silverstein MI, Singh H, Swan TL, Towbin RB, Trerotola SO, Bakal CW, for the Society of Interventional Radiology Standards of Practice Committee: Quality improvement guidelines for percutaneous management of the thrombosed or dysfunctional dialysis access. *J Vasc Interv Radiol* 14:S247-S253, 2003
- Beathard GA, Urbanes A, Litchfield T: The classification of procedure-related complications. A fresh approach. *Semin Dial* 19:527-534, 2006
- Aldrete JA, Kroulik D: A postanesthetic recovery score. *Anesth Analg* 49:924, 1970
- Chung F: Discharge criteria—a new trend. *Can J Anaesth* 42:1056-1058, 1995