RESIDENT IMPLEMENTATION OF THE 2007 ACC/AHA GUIDELINES ON PREOPERATIVE CARDIAC EVALUATION IN NON-CARDIAC SURGERY PATIENTS: IS CLINICAL EXPERIENCE ENOUGH?


Abstract

Background: Preoperative evaluation of surgical patients is important, as perioperative complications are associated with increased mortality. Specialties including anesthesiology, internal medicine, cardiology, and surgery are involved in the evaluation and management of these patients. This institutional study investigated the residents’ knowledge of the 2007 American College of Cardiology/American Heart Association (ACC/AHA) guidelines on perioperative evaluation of patients undergoing non-cardiac surgery.

Methods: This pilot study used a web-based survey questionnaire to assess resident’s knowledge of the 2007 ACC/AHA guidelines through individual steps and corresponding branch point(s) in twelve clinical scenarios. Additionally, residents were asked if they were aware of, or if they had received lectures on ACC/AHA guidelines. Staff anesthesiologists with training in cardiac and intensive care medicine validated the scenarios.

Results: A total of 104 resident participants were surveyed including 35 anesthesiology residents, 41 internal medicine residents, 20 surgery residents, and 8 cardiology fellows. Awareness of the 2007 ACC/AHA guidelines by specialty was: anesthesiology (85%), internal medicine (97.6%), cardiology (100%), and surgery (70%). Only 54.3% of anesthesiology, 31.7% of internal medicine, 100% of cardiology, and 10% of surgery residents stated they received lectures. The overall mean score achieved on the eleven scenarios was 50.4% for anesthesiology, 47.0% for internal medicine, 55.7% for cardiology, and 42.3% for surgery.

Conclusions: Although the majority of residents were aware of the 2007 ACC/AHA guidelines, fewer received lectures and regardless of specialty, implementation of these guidelines was poor. There exists significant room for improvement in the understanding of preoperative assessment of non-cardiac surgery patients.

* MD, MS
** MD
*** PhD

Affiliation: Department of Anesthesiology, Wayne State University, Detroit Medical Center; Detroit, Michigan, United States.

Corresponding author: Romeo N. Kaddoum, MD Assistant Professor; Wayne State University, Detroit Medical Center; 3990 John R, Rm 2901; 2-Hudson, Detroit, MI 48201, United States. Office: 1-313-745-7233, Fax: 1-313-993-3889. Email: rkaddou@med.wayne.edu
Introduction

Preoperative evaluation of surgical patients is critically important as perioperative complications are associated with increased costs and mortality. The American College of Cardiology (ACC) and American Heart Association (AHA), beginning in 1980, jointly established evidence-based guidelines to systematically facilitate cardiac evaluation in non-cardiac surgery patients. Numerous specialties including anesthesiology, cardiology, internal medicine and surgery are involved in the evaluation and management of patients undergoing surgery and thus should have facile and comprehensive knowledge of these guidelines. For this reason, we decided to investigate the residents’ knowledge, amongst the aforementioned specialties at our institution, of the 2007 ACC/AHA guidelines on perioperative cardiac management for patients undergoing non-cardiac surgery.

Methods

After institutional IRB approval (IRB#036612B3X) was obtained, we developed a pilot study at our institution using a web-based survey questionnaire to assess residents’ knowledge of the 2007 ACC/AHA guidelines on preoperative cardiac evaluation of patients undergoing non-cardiac surgery. Residents from anesthesiology, cardiology, internal medicine and general surgery were asked to complete this questionnaire (Appendix). Each resident was asked to identify which specialty they belonged to and level of training they were at, whether they were aware of the 2007 ACC/AHA guidelines and if they had lectures on these guidelines. Additionally, they were asked to answer twelve clinical scenarios developed to test their knowledge of each possible step and its corresponding branch point(s) of the 2007 ACC/AHA algorithm.

Appendix

Questions:
1. What is your area of specialization?
   a. Anesthesiology
   b. Internal Medicine
   c. Cardiology
   d. General Surgery

2. Which year of training are you in?
   e. If selected Anesthesiology – will have the following choices
      i. PGY-1
      ii. CA1
      iii. CA2
      iv. CA3
      v. Fellow
      vi. Other:
   f. If selected Internal Medicine
      i. PGY-1
      ii. PGY-2
      iii. PGY-3
   g. If selected Cardiology
      i. Fellow - first year
      ii. Fellow - second year
      iii. Fellow - third year
      iv. Other:
   h. If selected Surgery
      i. PGY-1
      ii. PGY-2
      iii. PGY-3
      iv. PGY-4
      v. PGY-5
      vi. PGY-6
      vii. Other:

3. Are you aware that there are guidelines for the preoperative evaluation of noncardiac surgery patients (e.g. 2007 ACC/AHA guidelines)?
   i. Yes
   j. No

4. Have you had any formal lectures or teaching that reviewed these guidelines?
   k. Yes
   l. No

5. Scenario 1:
A 58-year-old man with uncontrolled hypertension, CKD Stage III, and insulin-dependent diabetes mellitus with a HgbA1c of 10.7, who recently went to his primary care physician for complaints of worsening chest pain presents after being involved in a motor vehicle accident and is found to be hypotensive with significant abdominal ecchymoses with positive peritoneal lavage.

The most appropriate next step would be to:
1. Patient should undergo cardiac stress testing prior to surgery
2. Start patient on a β-blocker for heart rate control and proceed with surgery
3. Patient should go immediately to surgery
4. Patient needs cardiac catheterization prior to surgery
5. Patient needs a 2-D echocardiogram

6. Scenario 2:
A 71-year-old woman with hypertension, diabetes, right
upper extremity weakness with cervical stenosis, and renal insufficiency with Cr = 2.4 mg/dL comes for pre-operative evaluation for anterior cervical discectomy and fusion. She reports that she has been experiencing worsening chest pain and shortness of breath over the past week while gardening outside.

The most appropriate next step would be to:
1. Allow patient to proceed with surgery
2. Patient can proceed with surgery if her pre-operative EKG is normal
3. Start patient on a β-blocker for heart rate control and proceed with surgery
4. Patient should have cardiac stress testing prior to surgery
5. Patient should get cardiac catheterization prior to surgery

10. Scenario 6:
A 51-year-old man with history of smoking, gastroesophageal reflux, poorly controlled diabetes, and prior MI 3 months ago comes to the pre-operative clinic in preparation for a hiatal hernia repair. In the mornings, he walks with his wife for 30 minutes several times around the block without any difficulty.

The most appropriate next step would be to:
1. Patient can proceed with surgery if his pre-operative EKG is normal
2. Start patient on a β-blocker for heart rate control and proceed with surgery
3. Allow patient to proceed with surgery
4. Patient should undergo cardiac stress testing prior to surgery
5. Patient needs medical management of diabetes prior to surgery

11. Scenario 7:
A 69-year-old woman with long-standing diabetes, prior transient ischemic attack without residual deficits, and chronic renal insufficiency with Cr = 2.2 mg/dL presents for pre-operative evaluation for subtotal colectomy and ileostomy secondary to recurrent bleeding from diverticulosis. She is able to go up stairs to her bedroom; however, she must take short breaks to catch her breath.

The most appropriate next step would be to:
1. Patient can proceed with surgery if her pre-operative EKG is normal
2. Start patient on a β-blocker for heart rate control and proceed with surgery
3. Allow patient to proceed with surgery
4. Patient should undergo cardiac stress testing prior to surgery
5. Patient needs medical management of diabetes prior to surgery

12. Scenario 8:
A 53-year-old obese man with osteoarthritis and 35-pack year smoking history is scheduled for left knee replacement. He has a family history of stroke and his father died of an MI at 49 years of age. Pre-operatively his BP is 160/87 mm Hg.

The most appropriate next step would be to:
1. Patient can proceed with surgery if his pre-operative EKG is normal
2. Start patient on a b-blocker for heart rate control and proceed with surgery
3. Patient should undergo cardiac stress testing prior to surgery
4. Patient needs medical management of hypertension prior to surgery
5. Allow patient to proceed with surgery

13. Scenario 9:
A 79-year-old woman with uncontrolled diabetes, CKD stage II, NYHA class III CHF, and peripheral artery disease who is scheduled for a femoral to popliteal bypass due to worsening claudication. Patient’s pre-operative BP is 144/78 mm Hg and HR is 82 bpm.
The most appropriate next step would be to:
1. Patient can proceed with surgery if his pre-operative EKG is normal
2. Start patient on a b-blocker for heart rate control and proceed with surgery
3. Patient needs medical management of diabetes prior to surgery
4. Patient must undergo additional cardiac testing prior to surgery
5. Allow patient to proceed with surgery

14. Scenario 10:
A 86-year-old man with 30-pack-year smoking history, MI 3 years ago, poorly controlled diabetes, and claudications resulting from peripheral vascular disease is found to have a pulsatile abdominal mass. CT imaging shows a 6.7-cm abdominal aortic aneurysm. Patient’s pre-operative BP is 132/84 mm Hg and HR is 82 bpm.
The most appropriate next step would be to:
1. Patient can proceed with surgery if his pre-operative EKG is normal
2. Start patient on a b-blocker for heart rate control and proceed with surgery
3. Patient needs medical management of diabetes prior to surgery
4. Patient must undergo additional cardiac testing prior to surgery
5. Allow patient to proceed with surgery

15. Scenario 11:
A 63-year-old man with history osteoarthritis, 30-pack-year smoking history, and claudications from advanced peripheral vascular disease is scheduled for a Whipple secondary to pancreatic carcinoma.
The most appropriate next step would be to:
1. Patient can proceed with surgery if his pre-operative EKG is normal
The first scenario corresponded to step 1 of the algorithm identifying a patient who required emergency surgery. The second through fourth scenarios corresponded to step 2 of the algorithm identifying patients with active conditions including unstable angina, atrial fibrillation and severe aortic valve disease. Scenario five corresponded to step 3 of the algorithm with a patient presenting without any active conditions going for low risk surgery. Scenario six corresponded to step 4 of the algorithm with a patient with no active conditions going for intermediate risk surgery whose functional capacity was greater than four metabolic equivalents (METS). Scenario seven corresponded to step 5 of the algorithm with a patient of unknown functional capacity, no active conditions, and three clinical risk factors going for intermediate risk surgery. Scenario eight corresponded to step 5 of the algorithm with a patient with no active conditions, unknown functional capacity and no clinical risk factors going for intermediate risk surgery. Finally, scenarios nine, ten, and eleven corresponded to step 5 of the algorithm with patients with no active conditions, unknown functional capacity, going for high-risk surgery who have three, two and no clinical risk factors respectively.
Results

A total of 104 resident participated in the survey, including 35 anesthesia residents (34%), 41 internal medicine residents (39%), 20 surgery residents (19%), and 8 cardiology fellows (8%). Among the anesthesia residents, 6 PGY-1s, 9 CA-1s, 10 CA-2s, and 10 CA-3s responded; 68.6% of total number of anesthesia residents. There were three 1st year cardiology fellows, four 2nd year fellows and one 3rd year fellow who responded; 66.7% of total number of cardiology fellows. Among internal medicine residents, 10 PGY-1s, 18 PGY-2s, and 13 PGY-3s replied; 41.4% of total number of internal medicine residents. Finally, among surgery residents, 5 PGY-1s, 7 PGY-2s, 1 PGY-3s, 4 PGY-4s, 2 PGY-5s, and 1 PGY-7 responded; 37.7% of total number of surgery residents. Residents were asked about their awareness of the 2007 ACC/AHA preoperative guidelines and whether they had received specific lectures discussing these guidelines and their application in the evaluation of non-cardiac surgery patients (Table 1). Most residents were aware of the 2007 ACC/AHA guidelines while a substantially lower number received lectures on them. When comparing outcomes of both Anesthesiology and Internal Medicine residents between those who received lectures and those who had not, a slight improvement, 3% and 5% respectively, was seen although not statistically significant (p = 0.3 and p = 0.24, respectively). This comparison cannot be done with the cardiology fellows as 100% stated they received lectures and the surgical group would not be a valid comparison as only two residents stated they received lectures while 18 did not. The mean scores correct for all clinical scenarios between specialties are listed in Table 2. A statistical significance was seen between specialties (p = 0.012) with cardiology fellows performing the best. Since anesthesiaology and internal medicine had enough statistical power, further analysis between clinical training level and percent correct was done (Table 3). Although a trend towards better scores were seen with increased level of training, it was not statistically significant, with p = 0.33 and p = 0.06 respectively (Table 3). The eleven clinical scenarios were subdivided into two groups: scenarios 1-5 and scenarios 6-11. This was done as a large variation in percent correct between these two groups was noted and reached statistical significance p=0.0098, (Table 2).

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of Guidelines</td>
<td>Anesthesiology, n (%)</td>
<td>30 (85.7)</td>
</tr>
<tr>
<td></td>
<td>Internal Medicine, n (%)</td>
<td>40 (97.6)</td>
</tr>
<tr>
<td></td>
<td>Cardiology, n (%)</td>
<td>8 (100)</td>
</tr>
<tr>
<td></td>
<td>Surgery, n (%)</td>
<td>14 (70)</td>
</tr>
<tr>
<td>Totals, n (%)</td>
<td>92 (88.5)</td>
<td>12 (11.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>Anesthesiology, n (%)</td>
<td>19 (54.3)</td>
</tr>
<tr>
<td></td>
<td>Internal Medicine, n (%)</td>
<td>13 (31.7)</td>
</tr>
<tr>
<td></td>
<td>Cardiology, n (%)</td>
<td>8 (100)</td>
</tr>
<tr>
<td></td>
<td>Surgery, n (%)</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Totals, n (%)</td>
<td>42 (40.4)</td>
<td>62 (59.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specialty</th>
<th>PGY-1</th>
<th>PGY-2</th>
<th>PGY-3</th>
<th>PGY-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesiology</td>
<td>46.9</td>
<td>48.5</td>
<td>50.0</td>
<td>54.5</td>
</tr>
<tr>
<td>Internal Medicine</td>
<td>39.1</td>
<td>51.5</td>
<td>46.9</td>
<td>54.5</td>
</tr>
</tbody>
</table>

Discussion

Nearly 27 million anesthetics are delivered yearly in which a staggering 1 million patients will experience perioperative cardiac complications. Approximately 8 million patients have known coronary artery disease
or cardiac risk factors and 50,000 patients will suffer a perioperative myocardial infarction. These figures equate to 20 billion dollars in increased costs. Preoperative evaluation of surgical patients is critically important and relies upon close collaboration amongst physicians from multiple specialties. Evaluation is not done to provide clearance for surgery but rather to provide further clarification of a patient’s current medical condition, assess cardiac risk to guide peri-operative care and provide optimal medical management such that cardiac risk may be reduced.

There are clear associations between surgical procedures and adverse perioperative outcomes which is why a command of perioperative cardiac guidelines by physicians involved in the care of surgical patients, regardless of their specialty, is so vitally important.

An internist or surgeon is typically the first to encounter patients requiring surgical management. The role of the surgeon goes beyond devising a surgical plan for the patient but to also ensure that proper preoperative planning and consultation takes place such that perioperative risks are identified and minimized. In the inpatient setting, surgical patients are typically seen by either cardiology or internal medicine consultants who are expected to optimize and “clear” a patient prior to surgery. Typically, the anesthesiologist will encounter their patients the morning of surgery and within a very brief period of time are responsible for synthesizing all the medical information and testing and have to make a decision regarding whether the patient may proceed safely with surgery. It is not uncommon that patients are improperly evaluated and present with either poorly controlled chronic medical problems or acute pathology which either went unrecognized, typically by midlevel providers, or whose perioperative significance is unknown. This leaves the anesthesiologist in a highly undesirable situation where the pressures to proceed with surgery conflict with that of patient safety. This undoubtedly creates further stress on the patient as they wait for a decision to be made whether it is safe for them to proceed with surgery, resulting in poor patient care.

Due to increased healthcare costs, there is trend by hospitals to rely on phone interviews conducted by midlevel providers for preoperative patient evaluation. Thorough patient evaluation cannot be conducted in this manner as there are often gaps in patients’ understanding of their own medical problems and a disconnect between what constitutes relevant signs or symptoms by a patient and the health care provider conducting the interview. This further emphasizes the importance of directly conducting a detailed history and physical examination and medical evaluation. Additionally, evaluation of a patient’s functional capacity is an important step in the ACC/AHA guidelines. Providers who lack a more comprehensive understanding of the relationship between functional capacity and clinical risk factors may not be able to delineate reduced functional capacity due to, for example, osteoarthritis from that of poorly controlled cardiopulmonary disease. It is unclear if this trend shows any cost benefits or whether higher surgical cancellation rates are seen, however several studies have shown that preoperative patient evaluation does indeed reduce costs and the number of cancellations.

Medical guidelines are ubiquitous amongst all specialties. They provide a framework for which physicians can approach medical illnesses and in most instances are evidence-based. Lack of knowledge of guidelines amongst residents is not just a problem in anesthesiology but spans the entire medical profession. Karakousis et al., conducted a survey of U.S. medical resident familiarity with tuberculosis guidelines. They found that the median percent of questions answered correctly was 55% and most importantly there was not a significant increase in knowledge with increasing post-graduate years of training. Furthermore, Agrawal et al. conducted a survey of internal medicine residents to evaluate their knowledge of chronic kidney disease (CKD) and its management. They found that over 33% of residents did not know how to stage CKD and aside from traditional risk factors like hypertension and diabetes, a significantly lower percentage of residents knew that obesity, age and African American race were also risks factors. Like Karakousis et al, this study found that additional post-graduate experience did not result in meaningful improvement in knowledge. A study by Hoeks et al., applied the ACC/AHA guidelines retrospectively to patients undergoing peripheral vascular surgery. They found that patients in whom
the guidelines were inappropriately applied received the same amount of evaluation as those patients undergoing low-risk surgery. Hence, lack of guideline knowledge resulted in less use of cardioprotective medications like b-blockers. These studies along with ours demonstrate that clinical experience is indeed not enough on its own to provide a comprehensive knowledge of specialty specific guidelines.

In our study, there was a large variation in awareness of the 2007 ACC/AHA preoperative guidelines for patients undergoing non-cardiac surgery. Although 100% of cardiology fellows were aware of these guidelines only 70% of surgery residents were (Table 1). Although all cardiology fellows stated they had lectures specifically discussing the 2007 ACC/AHA guidelines, 54.3% of anesthesiology residents, 31.7% of internal medicine residents, and only 10% of surgery residents stated they received such lectures (Table 1). As mentioned earlier, only a slight, non-statistically significant improvement (3-5%) in questions correctly answered was seen among the anesthesiology and internal medicine residents who stated they received lectures. The eleven clinical scenarios were divided into two groups, scenarios 1-5 (steps 1-3 of algorithm) and scenarios 6-11 (steps 4-5). The first five scenarios focused on whether residents could identify that: patients requiring emergency surgery should proceed to the operating room without delay and that patients with active conditions including unstable angina, severe valvular disease or arrhythmias should not proceed with surgery but rather undergo a thorough medical evaluation. Among all specialties, the residents correctly answered the first group of scenarios with a mean score of 80.3%. The residents answered the second group of scenarios with a mean score of 22.6% (Table 2). This can be explained as the second group of clinical scenarios required residents to have a deeper understanding of the 2007 ACC/AHA guidelines and how functional capacity, risk of surgical procedures, and clinical risk factors govern the level of preoperative workup required before surgery should take place. It is safe to say that even without the knowledge of the 2007 ACC/AHA guidelines, residents can appreciate both the need to proceed with emergency surgery and that patients who are acutely decompensated require further medical evaluation.

Concerns about cancellations and surgical delay, medico-legal liabilities and beliefs that “other” physicians want certain tests or evaluations to be completed has lead to increased waste, costs, utilization of resources, morbidity, and lack of proper preoperative evaluation. Hence, guidelines provide for a more systematic approach to patient evaluation; however poor adherence is multifactorial and is attributed to lack of awareness, perpetuation of old practice habits, personal preferences, and administrative constraints.

Although much effort was made by all programs and their coordinators, resident participation was less than desirable, which significantly limited the power of our study. Another limitation was given that our study was conducted via a web-based survey; residents could theoretically collaborate in answering the questions. We felt however that if this occurred, it would be amongst a minimal number of residents. Additionally, the honor code should act as a sufficient reminder that accurate results were desired so that the assessment of the deficiencies in resident knowledge could take place and appropriate modifications in resident education could be made. Despite these limitations, it is clear that much improvement needs to be made in educating residents about preoperative management of non-cardiac surgery patients. Even though residents receiving lectures did slightly better overall, it is likely that the number, depth and application of the 2007 ACC/AHA guidelines in the form of problem-based learning could improve overall performance. Clinical training by itself arguably increases a resident’s ability to evaluate and manage patients but as our study and others have shown, it is neither a substitute or sufficient in producing physicians with comprehensive skills in preoperative patient management.

**Conclusions**

Although the majority of residents were aware of the 2007 ACC/AHA guidelines, implementation of these guidelines was poor. Despite increased training there was no significant difference in residents’ ability to apply the 2007 ACC/AHA guidelines appropriately. There exists significant room for improvement in the understanding of preoperative assessment of non-cardiac surgery patients amongst all specialties involved in the care of these patients.
References


6. AuERbach AD, Goldman L: Beta-Blockers and reduction of cardiac events in noncardiac surgery: scientific review. JAMA; 287:1435-44.


BRIDION—for optimal neuromuscular blockade management and improved recovery

**Predictable and complete reversal**
- 98% of BRIDION patients recovered to a TOF* ratio of 0.9 from reappearance of T2 after 5 minutes
- 97% of BRIDION patients recovered to a TOF* ratio of 0.9 from 1 to 2 PTCs after 5 minutes

**Rapid reversal**
- BRIDION rapidly reversed patients from reappearance of T2 in 1.4 minutes
- BRIDION rapidly reversed patients from 1 to 2 PTCs in 2.7 minutes

BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade.1

**Important safety information**
BRIDION is not recommended in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with great caution. Caution should be exercised when administering BRIDION to pregnant women as no clinical data on exposed pregnancies are available.

BRIDION has not been investigated in patients receiving rocuronium or vecuronium in the Intensive Care Unit (ICU) setting.

If neuromuscular blockade is required within 24 hours of BRIDION administration, a nonreversal neuromuscular blocking agent should be used instead of rocuronium or vecuronium. The most commonly reported adverse reactions were dysgeusia (metal or bitter taste) and anesthetic complications (movement, coughing, grimacing, or spluttering on the endotracheal tube). In patients treated with BRIDION, a few cases of awareness were reported. The relation to BRIDION was uncertain. In a few individuals, allergic-like reactions (ie, flushing, erythematous rash) following BRIDION were reported. Clinicians should be prepared for the possibility of allergic reactions and take the necessary precautions. In a trial of patients with a history of pulmonary complications, bronchoscopy was reported in 2 patients and a causal relationship could not be fully excluded.

Volunteer studies have demonstrated a slight (17%-22%) and transient (<30 minutes) prolongation of the prothrombin time/activated partial thromboplastin time (PT/aPTT) with BRIDION; however, clinical studies have demonstrated no clinically relevant effect on peri- or postoperative bleeding complications with BRIDION alone or in combination with anticoagulants. As BRIDION has demonstrated an in vitro pharmacodynamic interaction with anticoagulants, caution should be exercised in patients on anticoagulation for a pre-existing or comorbid condition. This pharmacodynamic interaction is not clinically relevant for patients receiving routine postoperative prophylactic anticoagulation. Although formal interaction studies have not been conducted, no drug interactions were observed in clinical trials. Preclinical data suggest that clinically significant drug interactions are unlikely with the possible exceptions of toremifene, fusidic acid, and hormonal contraceptives.

* Train-of-four
* Post-tetanic counts
* Second twitch

**REFERENCES**
1. BRIDION Summary of Product Characteristics (SPC)

Please see summary of product characteristics for full prescribing information.
TAP Block And InfiltraLong
For Effective Treatment Of Long And Deep Incisions

Sono Cannulas
For Single Shot UltraSound Guided Nerve Blocks

SonoSystem And SonoLong Curl
For UltraSound Guided Nerve Blocks

Sprotte® 2.G
The New Generation Dura Punctre In Minimum Time

SonoEye Ophtalmic Block
For Peribulbar And Retrobulbar Blocks Under Ultrasonic Monitoring

www.mediline-lb.com Tel:+961 1 697500
Thanks to AirStop in the drip chamber – the sight of a container running empty is no longer cause for alarm and no reason for energy and time to be wasted rushing around because the patient gets upset.

When the container is empty, AirStop maintains a constant fluid level. No air can get through to the patient.

Thanks to the PrimeStop at the patient connector – you can now prepare several infusions at once, quicker and more hygienic than ever before. Right away your hands are free to prepare the next infusion.
Question.

Your patient requires urgent pain medication. How can you administer this less invasively?

Answer.

References: