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Clinical Cardiology

Critical analysis of the latest clinical research in cardiovascular medicine [ALERT]

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Intravenous Fluids in Patients With Acute Heart Failure

By Van Selby, MD

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Dr. Selby reports no financial relationships relevant to this field of study.

SOURCE: Bikdeli B, et al. Intravenous fluids in acute decompensated heart failure. *JACC Heart Failure* 2015;3:127-133.

Volume overload is a hallmark of acute heart failure (AHF). In hospitalized patients, intravenous loop diuretics are the most commonly used treatment for decongestion and symptom relief. Intravenous (IV) fluids are routinely administered to hospitalized patients, although their use in patients with AHF seems counterintuitive. No previous study has evaluated the frequency and effects of IV fluid administration among patients hospitalized for AHF.

To examine this issue, Bikdeli and colleagues analyzed records from the Premier database, which represents approximately 20% of acute care hospitalizations in the United States. They identified 131,430 patients who were hospitalized for heart failure between 2009 and 2010 and treated with a loop diuretic within the first 2 days of hospitalization. Patients with sepsis, bleeding, anaphylaxis, or need for vasopressors were excluded.

The authors found that 11% of patients admitted for AHF also received at least 500 mL of IV fluid during the first 2 days of hospitalization, with a median volume of 1000 mL. There was wide variation in the fluid utilization rate between hospitals, ranging from 0%-71.1%, with a median of 12.5%. One quarter of all hospitals gave IV fluids to at least 20% of patients with AHF.

After controlling for baseline characteristics, patients who received IV fluids had significantly higher rates of subsequent ICU admission (5.7% vs 3.8%; $P < 0.0001$), and in-hospital death (3.3%

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vs 1.8%; $P < 0.0001$), as well as higher rates of intubation and need for renal replacement therapy. There was no significant difference in the median length of stay between those who did and did not receive fluids. The authors conclude that administration of fluids to patients with AHF is not uncommon, may be associated with adverse events, and represents a possible opportunity for improvement.

■ COMMENTARY

Although simultaneously administering IV fluids and diuretics to AHF patients seems illogical, we see that it happens with surprising frequency. Furthermore, there appears to be a clear negative association between use of IV fluids and adverse outcomes in this population. Hopefully, this paper will serve as a wake-up call to those who care for patients with AHF, and help us take steps to avoid simultaneous use of fluids and diuretics.

Assessment of volume status is often challenging, and the concomitant use of fluids and diuretics may reflect a health care provider's uncertainty. There may be different, even opposing, opinions about a given patient's volume status among members of the treating team, compounded by a lack of clear communication between team members, and resulting in use of opposing therapies. Patients with AHF also frequently present with, or develop, hypotension and renal insufficiency, conditions that are commonly treated with IV fluids in the general population. Without careful consideration of the underlying physiology, these same interventions may be reflexively applied to patients with heart failure.

One particularly striking finding is the wide variation in fluid utilization rates across hospitals. This could be due to underlying differences in practice culture between hospitals. Alternatively, some hospitals may have systematic mechanisms in place that routinely lead to use of IV fluids, such as automated order sets. Identifying these factors is an important step toward eliminating the pathways that lead to inappropriate use of fluids.

This study has clear limitations. By using an administrative database, the authors could not identify the particular reason a given patient may have received IV fluids. It is possible the patients who received fluids were sicker, or fluids were given to counteract over-aggressive diuretic use. The authors took steps to avoid these pitfalls, such as limiting the timeframe to the first 2 days of hospitalization and excluding patients with other indications for fluids such as sepsis or anaphylaxis. However, there may have been underlying differences in the patient populations that could not be accounted for.

This study shines a light on an issue that has gone largely unnoticed in the management of AHF. Identifying the frequency and consequences of IV fluid use in patients with AHF is the first step toward finding a solution. Providers should make sure there are no institutional factors contributing to the overuse of fluids in these patients, such as automated order sets that routinely include fluids. Careful assessment of volume status remains one of the most important skills in heart failure management and cannot be neglected. Clear communication among team members is critical to make sure there is a cohesive treatment plan. By keeping these in mind, hopefully we can reduce the push-pull of simultaneously administering diuretics and fluids. ■

Bridging During Anticoagulation Interruptions Is Associated with Worse Outcomes

By Cara N. Pellegrini, MD

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Dr. Pellegrini reports no financial relationships relevant to this field of study.

SOURCE: Steinberg BA, et al. Use and outcomes associated with bridging during anticoagulation interruptions in patients with atrial fibrillation: Findings from the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF). *Circulation* 2015;131:488-494.

Despite the routine nature of discontinuing atrial fibrillation (AF) patients' long-term oral anticoagulation (OAC) for procedures and "bridging" them with another agent, there is remarkably little data on the safety and benefit of this practice. Guidelines detailing when and how to initiate bridging therapy have been published, but data supporting why we should bridge at all are limited.[1] To help fill this void, Steinberg and colleagues used a national, community-based registry of outpatients with AF (ORBIT-AF) to examine current practices around periprocedural OAC management and associated outcomes. Outcomes evaluated included rates of major bleeding, as well as myocardial infarction, stroke or systemic embolism, cause-specific hospitalization, and death within 30 days.

Their final study cohort consisted of 7372 patients, with a median follow-up of 24 months. They found a large proportion (30%) of patients had an interruption in their OAC during the study; of these, approximately one-quarter were bridged, most commonly with low-molecular weight heparin (73%), but a sizable minority with unfractionated heparin (15%). The decision to bridge a patient appeared to be driven primarily by the patient's history of a prior cerebrovascular event (22% bridged vs 15% no bridging; $P < 0.001$), history of congestive heart failure (44% vs 34%; $P < 0.001$), and presence of a mechanical valve (9.6% vs 2.4%; $P < 0.001$). As expected, mean CHA2DS2-VASc scores were slightly higher in the bridged group as well (4.25 vs 4.03; $P = 0.01$). Interestingly, not only were bleeding events more common in the bridged group (5.0% vs 1.3%; adjusted odds ratio, 3.84; $P < 0.001$), but the incidence of the composite outcome of myocardial infarction, stroke or systemic embolism, major bleeding, cause-specific hospitalization, and death within 30 days was also significantly higher in the bridged group (13% vs 6.3%; adjusted odds ratio, 1.94; $P < 0.001$). The authors concluded that their data do not support the use of routine bridging anticoagulation.

■ COMMENTARY

Clearly the biggest limitation of this trial was inherent in its design — this was not a randomized, controlled trial. The patient factors that led to their presumed designation as higher risk and, therefore, the decision to bridge them, also could have contributed to their worse outcomes. The authors attempted to correct for this by performing a multivariate-adjusted analysis to control for known biases, such as the higher CHA2DS2-VASc scores in the bridged group, but residual or unmeasured confounding cannot be excluded. Stay tuned for the results of the ongoing Effectiveness of Bridging Anticoagulation for Surgery (BRIDGE) study, which will be able to address the issue of causality, and which has now completed randomization of about 2000 patients undergoing surgery to low-molecular weight heparin bridging or placebo during the perioperative period.

Nonetheless, there are some important lessons for now. Bridging almost certainly comes at a cost, at a minimum, of an increased bleeding risk. This finding echoes that of a recent meta-analysis of > 12,000 patients from 34 studies (only one of which was a randomized controlled trial), which found bridging therapy to be associated with an increased risk of bleeding events, and a similar risk of thromboembolic events.[2] Given the mounting evidence that bridging may be harmful, or at least not as helpful as we thought, unless patients are at particularly high risk for a thromboembolic event, it seems prudent to not bridge. Additionally, extra consideration of whether bridging is necessary should be given to patients undergoing certain procedures, such as endoscopy and catheter ablation, that appear to have excess risk (bleeding and cardiovascular events respectively) with a bridging approach.

Perhaps even better is to not interrupt OAC for

procedures at all. While this was not a primary focus of this study, there is a growing body of literature supporting that approach for catheter ablation of AF and cardiac device implantation.[3,4] Particularly low-risk procedures, such as dental work, minor skin procedures, or cataract surgery in which bleeding can be locally prevented (with a special mouthwash for example) or is expected to be minimal, do not generally warrant OAC interruption. Approximately 5% of the patients treated with dabigatran at baseline (the only novel agent included in this study) were bridged, a number appropriately less than the overall 25% bridging rate, but still probably higher than should be targeted when novel agents with a fast onset/offset are used. When bridging is performed, particular attention should be paid to periods of transition, such as hospital discharge, and needs for dosage adjustment to minimize the risks. While this study did not provide comparison data for low molecular weight heparin vs unfractionated heparin, other studies, such as BRUISE CONTROL, did not detect a significant difference between these bridging approaches.[4] ■

REFERENCES

1. January CT, et al. 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: A Report of the American College of Cardiology / American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. *Circulation* 2014;130:e199-267.
2. Siegal D, et al. Periprocedural hearpin bridging in patients receiving vitamin K antagonists: Systematic review and meta-analysis of bleeding and thromboembolic rates. *Circulation* 2012;126:1630-1639.
3. Di Biase L, et al. Periprocedural stroke and bleeding complications in patients undergoing catheter ablation of atrial fibrillation with different anticoagulation management: Results for the Role of Coumadin in Preventing Thromboembolism in Atrial Fibrillation (AF) Patients Undergoing Catheter Ablation (COMPARE) randomized trial. *Circulation* 2014;129:2638-2644.
4. Birnie DH, et al. Pacemaker or defibrillator surgery without interruption of anticoagulation. *N Engl J Med* 2013;368:2084-2093.

Surgical Management of Infective Endocarditis

By Michael H. Crawford, MD, Editor

SOURCES: Chu VH, et al. Association between surgical indications, operative risk, and clinical outcome in infective endocarditis: A prospective study from the international collaboration on endocarditis. *Circulation* 2015;131:131-140; Erbel R. The new strategy in infective endocarditis: Early surgery based on early diagnosis: Are we too late when early surgery is best? *Circulation* 2015;131:121-123.

Although guidelines outline specific indications for surgery in infective endocarditis (IE), applying these recommendations in the clinical area is challenging. In order to understand these challenges, the International Collaboration on Endocarditis (ICE) conducted a prospective study to evaluate the factors that influence the decision with regard to surgical intervention in IE. From the ICE database, patients with left-sided IE enrolled between 2008 and 2012 were selected for this analysis. Among the 1296 patients, 314 (25%) had prosthetic valve IE. Surgery was performed in 733 (57%). Indications for surgery were heart failure, embolic event, persistent bacteremia, paravalvular complications, severe regurgitation, vegetation size, and microorganism type. Among the 863 with indications for surgery, 661 (77%) had surgery. Those undergoing surgery were younger compared to those who did not have surgery (57 vs 68 years, $P < 0.001$). Also, they more often had severe aortic regurgitation (odds ratio [OR] = 2.4), abscess (2.0), and embolic events (1.7). Factors associated with no surgery despite indications were liver disease (OR = 0.16), stroke (0.54), or *Staphylococcus aureus* (0.50). The reason cited for not operating with *S. aureus* was sepsis. The Society of Thoracic Surgeons (STS) preoperative risk score averaged 24 in those going to surgery. Surgery was associated with higher 6-month survival, and survival was related to the STS score. Surgical indications and an STS score above the median resulted in about a 90% 6-month survival; whereas, those with an STS below the median had about a 70% 6-month survival. Those with a surgical indication with an STS above the median and no surgery had the worst prognosis, < 30% 6-month survival. The authors concluded that the performance of surgery in patients with IE generally followed guidelines, except for patients with *S. aureus*. Despite *S. aureus* being the most common cause of IE in the current era and an indication for surgery in most guidelines, surgery was performed less often in *S. aureus* IE patients.

■ COMMENTARY

The widespread use of transesophageal echocardiography (TEE) in the last 20 years has markedly improved the sensitivity for detecting IE (now 96%) and its complications. However, mortality has not changed over the last 2 decades. Many believe that part of the reason mortality has not decreased with earlier diagnosis of the disease is that early surgery is often not done despite guideline recommended indications being present. In this study from the prospective, observational ICE database, 30-day mortality in those with indications for surgery who had surgery was 15% vs 26% in those with indications for surgery in whom it was not done. Surprisingly, 25% of patients with indications for surgery did not get it. The major reasons for not doing indicated surgery were comorbidities that raised operative risk and *S. aureus* sepsis. Naturally, the STS score was higher than what would be encountered in other types of cardiac surgery, since healthy people rarely get IE. Also, STS score was related to outcome as one would expect. On the other hand, surgery can be lifesaving for patients unlikely to be cured by medial therapy.

In addition to being an observational study, there are other weaknesses of this study. It was conducted in large tertiary centers and half the patients were transferred from other hospitals. So there is likely a referral bias. Also, the study was done in several countries and not adjusted for differences in practice patterns. Finally, the data were not adjudicated centrally. On the other hand, randomized trials are unlikely to ever be done in IE. Also, this was a comprehensive study that looked at 275 clinical variables. Older studies demonstrated the benefits of surgery, but lacked the detailed information in this study.

This study emphasizes that early surgery before antibiotics have been able to fully work should be strongly considered when published indications are present, since successful surgery improves survival. When the STS score is < 24, the 6-month survival was excellent (about 90%). Even when the STS score was > 24, the 6-month survival was about 70%; lower but clearly better than the alternative of failed medical therapy. ■

Implantable Coronary Sinus Narrowing Device Shows Promise in Refractory Angina

By Jeffrey Zimmet, MD, PhD

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Dr. Zimmet reports no financial relationships relevant to this field of study.

SOURCE: Verheye S et al. Efficacy of a device to narrow the coronary sinus in refractory angina. *N Engl J Med* 2015;372:519-527.

Despite advances in medical therapy and in coronary revascularization techniques, the population of patients with chronic, stable, but debilitating angina continues to grow. The mortality of such patients is surprisingly low, such that patients with this disorder often suffer limiting symptoms for many years. Clearly more options for treatment are needed, but what?

The area of surgical manipulation of the cardiac venous anatomy, rather than the coronary arterial supply, has a fascinating history dating back as far as the 1940s. More recent advocates have theorized that increasing the pressure in the coronary sinus may lead to redistribution of collateral blood flow from non-ischemic into ischemic territories of the myocardium. An implantable, stainless-steel, balloon-expandable stent designed to create a narrowing within the coronary sinus (The Coronary Sinus Reducer, Neovasc Medical, Inc) and, thus, increase coronary venous pressure was initially presented in a phase 1 first-in-human study published in *JACC* in 2007. That trial, which was a nonrandomized, open-label study in 15 patients, reported a high degree of safety as well as a clinical benefit maintained at 3 years of follow up. A phase 2 study of the device was recently published in the *New England Journal of Medicine*.

In this study, 104 patients with Canadian Cardiovascular Society (CCS) class III or IV angina who were on maximal medical therapy and deemed not to be candidates for further revascularization were randomized to receive the Reducer device or a sham procedure. Medical therapy included beta-blockers, calcium channel blockers, and short- and long-acting nitrates, as well as two medications not currently available in the United States — nicorandil

and ivabradine. In each case, evidence of reversible ischemia was required for enrollment. Patients with recent revascularization or acute coronary syndrome were excluded, as were patients with severely reduced ejection fraction (EF) (<25%) and those with permanent pacemaker or defibrillator leads in the right heart.

All patients underwent a right heart catheterization and coronary sinus angiogram. Those with appropriate anatomy for the device were eligible for randomization (the percentage of patients who were anatomically ineligible for the procedure is not reported). Although the implanting physicians obviously were aware of the randomization, the patients as well as downstream investigators performing follow-up assessments were kept blinded. Among the 52 patients assigned to the treatment group, 50 had successful implantation of the device.

At the 6-month follow up, 35% of patients in the treatment group showed an improvement of at least two Canadian Cardiovascular Society (CCS) classes (the pre-specified primary endpoint), vs 15% in the control group ($P = 0.02$). In the treatment group, 71% had an improvement of at least one CCS class, as compared with 42% in the control group ($P = 0.003$). Quality of life, as assessed by the Seattle Angina Questionnaire, was also significantly improved in the device group.

The procedure did not show significant improvements in other endpoints when compared with controls, including angina stability and frequency, exercise duration, change in the time to ST-segment depression, or change in the wall-motion index on dobutamine stress echocardiography.

The authors concluded that the device showed an improvement in angina and quality of life in patients with refractory angina, but larger studies would be needed to assess objective measures of ischemia.

■ COMMENTARY

Over the years, many competing therapies have been investigated for refractory angina, including trans-myocardial laser revascularization, gene therapy, cell therapy, and so on — all have shown initial promise, but solid randomized trial data are lacking for most. A significant number of patients remain undertreated, and the need for further therapeutic options is clear.

This was a well-done trial, which included a sham procedure control, which is increasingly recognized as an essential element in trials assessing the effect of procedures on a subjective endpoint such as angina. Given this recognition, however, an assessment of the effectiveness of blinding would have been an appropriate addition (such assessments have been featured in other recent trials, such as SYMPLICITY HTN-3).

Although the reported benefits seem promising, the study size is simply too small to make definitive conclusions. A larger phase 3 study will be needed to corroborate these findings and, potentially, to predict which patients are most likely to benefit.

Even if the reported benefits are true, do the reported effects — only 71% of patients showing at least one CCS class improvement — justify an expensive invasive procedure? Only further investigation will tell. ■

Ticagrelor Cost Effective as Well as Efficacious, According to New Analysis

By Jeffrey Zimmet, MD, PhD

SOURCES: Cowper PA, et al. Economic analysis of ticagrelor therapy from a U.S. perspective: Results from the PLATO study. *J Am Coll Cardiol* 2015;65:465-476; Kazi DS, Hlatky MA. A delicate balance: The cost effectiveness of new antiplatelet agents [editorial]. *J Am Coll Cardiol* 2015;65:477-479.

The PLATO trial randomized more than 18,000 acute coronary syndrome (ACS) patients to dual anti-platelet therapy with aspirin plus either clopidogrel or the newer P2Y12 inhibitor ticagrelor. Compared with clopidogrel-treated patients, those on ticagrelor had lower rates of death and myocardial infarction at 1 year. Despite superior ischemic outcomes, both ticagrelor and the thienopyridine prasugrel have been relatively slow to be adopted in the United States. This is at least in part due to the cost differential, as the older clopidogrel is available as a generic, while the newer agents enjoy continued brand exclusivity. The National Average Drug Acquisition Cost

data collected by CMS currently reports a 70-fold difference in price between clopidogrel and ticagrelor.

In this prospectively designed cost-effectiveness analysis, the authors used U.S. estimates of resource use and associated costs, but employed effectiveness data from the trial as a whole. Recall that the 1400 or so U.S. patients did not show the same degree of benefit from ticagrelor compared with patients in the rest of the world. In post-hoc analyses, higher average maintenance doses of aspirin in North American patients were identified as a potential modifier, leading to the FDA black box warning against use of aspirin doses > 100 mg in combination with ticagrelor. The authors made the assumption that the use of low-dose aspirin would produce similar reductions in clinical events among U.S. patients, as in the overall PLATO trial.

During the index hospitalization, costs were similar between groups, with comparable degrees of revascularization and no significant difference in mean number of readmissions. No significant difference in non pharmaceutical medical expenditures was noted between groups. A lifetime extrapolation model projected that life expectancy of ticagrelor patients would exceed that of clopidogrel patients by 0.14 quality-adjusted life years (QALYs), or 2.6 months. Based on an incremental drug cost of $2172 for ticagrelor vs generic clopidogrel for 12 months, they calculated the incremental cost-effectiveness ratio (ICER) for ticagrelor compared with clopidogrel of $29,665/QALY. In this analysis, ticagrelor appeared to be more cost effective in patients who underwent invasive revascularization ($27,331/QALY) than among patients who were managed conservatively ($47,068/QALY).

Using commonly accepted willingness-to-pay thresholds of $50,000 and $100,000/quality-adjusted life-year, the authors concluded that the additional costs of improved life expectancy with ticagrelor compare favorably with accepted standards for medical interventions in the United States.

... THIS STUDY PROVIDES REASSURANCE THAT TICAGRELOR HITS GENERALLY ACCEPTED METRICS FOR U.S. COST EFFECTIVENESS, AND TREATMENT DECISIONS MAY BE MADE BASED ON THE BEST AVAILABLE CLINICAL DATA.

■ COMMENTARY

This is an interesting study that addresses a central point regarding value in health care. When newer, more costly therapies become available, cost effectiveness is all too easy to overlook in the metrics of treatment decisions.

It is important to note several things about this study. The first involves the PLATO study itself, and the apparent paradox wherein U.S. patients did not show the same relative benefit of ticagrelor (indeed, when analyzed separately they did not show benefit at all) compared with the rest of the world. The FDA has adopted the judgement of the post-hoc analysis that concluded that higher aspirin doses among North American patients were responsible for this effect, and, therefore, the approval for ticagrelor carries a warning against use in combination with doses of aspirin > 100 mg. Although this study assumes the level of benefit from PLATO as a whole, there is no guarantee that this will occur in U.S. patients taking the lower aspirin dose.

In an accompanying editorial, Drs. Kazi and Hlatky note that we should use caution extrapolating the results of a randomized trial to real-world practice. The twice-daily dosing of ticagrelor, along with the higher noted rate of subjective dyspnea, may well have effects on medication adherence that will be more marked outside the context of a clinical trial, for example. They also discuss the fact that alternative agents such as prasugrel, and varying strategies such as individualized assessment with genotyping or platelet function testing of clopidogrel's likely efficacy need to be considered. As they point out, "Incremental cost effectiveness is always defined relative to an alternative, and the PLATO study examined only one of the many strategies for post-ACS antiplatelet use."

Although these estimates should ultimately be revised with post-marketing real world data, for now, this study provides reassurance that ticagrelor hits generally accepted metrics for U.S. cost effectiveness, and treatment decisions may be made based on the best available clinical data. ■

QUESTIONS & COMMENTS:
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CME INSTRUCTIONS

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CME QUESTIONS

1. IV fluids during the first 2 days of hospitalization are appropriate in all but which of the following conditions?

A. Sepsis

B. Major GI bleeding

C. Acute heart failure

D. Anaphylactic shock

2. When patients on oral anticoagulants undergo surgery, bridging with heparin results in:

A. more bleeding.

B. less thromboembolic events.

C. shorter hospital stays.

D. less surgical mortality.

3. Which of the following have shown initial promise in treating refractory angina pectoris?

A. Stem cell therapy

B. Coronary sinus flow reduction stent

C. Trans myocardial laser revascularization

D. All of the above

4. Which of the following is correct concerning ticagrelor use in ACS as studied in the PLATO trial?

A. It is within cost effectiveness standards.

B. It prolongs life.

C. Its efficacy was not seen if used with > 100 mg of aspirin daily.

D. All of the above

5. In a large infective endocarditis database, patient comorbidities and what other factor was associated with withholding surgery even when indicated?

A. The surgeons experience

B. Need to sterilize the blood stream

C. *S. aureus* infection

D. IV drug abuse by the patient

CME OBJECTIVES

Upon completion of this educational activity, participants should be able to:

- discuss the most current information related to cardiac illness and the treatment of cardiac disease;
- explain the advantages and disadvantages, as well as possible complications of interventions to treat cardiac illness;
- discuss the advantages, disadvantages, and cost-effectiveness of new and traditional diagnostic tests in the treatment of cardiac illness; and
- discuss current data regarding outpatient care of cardiac patients.