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Focus on Rehabilitation

A PUBLICATION FROM THE KESSLER REHABILITATION CORPORATION

Improving outcomes and lowering costs in thromboembolism prevention: dalteparin versus enoxaparin

A recent study compared the efficacy, safety and cost of two low-molecular-weight heparins in preventing thromboembolism. Results point to a more cost-effective way to prevent deep-vein thrombosis in joint replacement.

Robert Krotenberg, M.D.

In recent years, low-molecular-weight heparins (LMWHs) have become the standard for preventing thromboembolism in total knee and total hip replacement patients. Their superiority to unfractionated heparin is well established, but data are rare on the comparative costs and benefits of the two commonly used LMWHs, dalteparin (Fragmin, manufactured by Pharmacia) and enoxaparin (Lovenox, made by Aventis). Now, new research conducted at Kessler Institute for Rehabilitation sheds light on which drug offers greater cost savings with comparable or superior clinical benefits.[1]

The conclusions from this study are particularly important and timely given the recent Medicare reimbursement changes for rehabilitation facilities. (See "Public Policy View," page 5). In light of this new prospective payment system, it is more essential than ever to conserve rehabilitation costs without compromising patient care.

Kessler researchers analyzed the clinical and economic effects of a formulary change in which dalteparin was adopted as the first-line therapy for deep-vein thrombosis (DVT) prevention in total hip and total knee replacement patients. The change was made based on literature showing comparable efficacy and safety for dalteparin, as well as lower acquisition and administration costs.

Included in the study were 461 joint replacement patients; 243 total hip and 218 total knee replacement patients who were given either 30 mg enoxaparin twice daily or 5000 IU dalteparin once daily. If a patient in the study developed a blood clot, enoxaparin was used for treatment.

In addition to lower costs, dalteparin also provided the patient convenience of once-daily dosing. Enoxaparin 40 mg also has FDA approval for once-daily dosing, but was not part of the formulary change because it has not been approved for total knee replacement patients and because of reports that it may be less efficacious than twice-daily dosing of enoxaparin 30 mg. The outcomes that were recorded and analyzed included effectiveness, safety and costs of the two therapies.

> The average cost of prophylaxis for a patient receiving dalteparin was $91 less.

Dalteparin reduces DVT risk

The age-related risk of DVT was found to be lower among dalteparin patients than for those taking enoxa-

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Focus on
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Focus on Rehabilitation is published quarterly as a service to the medical community by Kessler Rehabilitation Corporation to bring current issues and advances to the attention of practicing physicians.

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VOLUME 1 • ISSUE 1

LETTER FROM THE EDITOR

Insights you can use

Bruce M. Gans, M.D.

We at Kessler are proud to present the inaugural issue of *Focus on Rehabilitation*, a quarterly newsletter for physicians who are intimately involved in the delivery of medical rehabilitation services.

We do so knowing that you're not looking for more things to read that will distract you from caring for your patients. To the contrary, many of you would be happier if we could somehow send you fresh chunks of time to read the journals that you already receive.

We hope to do the next best thing—to respect your time by delivering substantive information succinctly. We'll spare you the latest ribbon-cutting news, and also the fine print on the double-blind study that didn't quite prove anything. Above all, we want *Focus on Rehabilitation* to be of practical use.

Rehabilitation medicine is fast advancing, and Kessler physicians are at the forefront of the changes. In these pages, we'll share our experience, discoveries and views with other practitioners—our colleagues in physical medicine and rehabilitation, and physicians in other specialties whose patients are embarking on the long road to recovery.

"Above all, we want *Focus on Rehabilitation* to be of practical use."

What topics will we "focus" on? This first issue offers a sample. In our front-page article, Robert Krotenberg, M.D., employs the principles of evidence-based medicine to highlight a medication choice that can enable top-quality care in the prevention of thromboembolism to be delivered more cost-effectively. That's a key consideration at a time when the new Medicare Rehabilitation Prospective Payment System is revolutionizing reimbursement, as I discuss in "Public Policy View" on page 5.

Our "Clinical Pearls" department in each issue will offer a clinician's practical, experience-based guidance in dealing with a particular problem. This time it's Steven Kirshblum, M.D., on preventing—or treating—deep-vein thrombosis after spinal cord injury (page 8). And if you believe, as we do, that less grave conditions deserve the same clinical excellence as do life-threatening ones, you'll want to read the interview on page 4 with Gerard Malanga, M.D., co-editor of a new book on cervical whiplash injuries.

Constraint-induced therapy is a recently rediscovered treatment in the field; Ross Bogey, D.O., highlights not only the research, but also the state of affordable treatment options in his article on page 3. Finally, as an actively involved corporate citizen in the world of organized medicine, we at Kessler feel a responsibility to address issues of medical education, specialization and the organization of the profession. On page 6, Joel A. DeLisa, M.D., looks at what is happening to board certification as it becomes less of a static credential and more of an ongoing process.

We don't have all the answers—or even all the questions. That's why we welcome your thoughts on *Focus on Rehabilitation* and the clinical issues it raises. Feel free to contact me by phone **(973-243-8535)** or e-mail **(bgans@kessler-rehab.com)** with inquiries or comments on the articles we publish—or the ones we should publish next.

We do, however, hope that reading this publication will become a habit that repays the few minutes spent with some additional insight that will help you meet the challenge that matters most: caring for your patients.

—Bruce M. Gans, M.D., Editor-in-Chief

Constraint-induced therapy brings new hope for stroke patients

Forcing use of a stroke-impaired hand or arm can restore function by helping the brain reroute control through different neuronal pathways.

Ross Bogey, D.O.

Writing a letter, handling a fork, pouring a cup of coffee—these activities all demand a level of hand and arm function that most stroke patients can't achieve. Yet a new therapy program developed by Kessler researchers is restoring stroke patients' coordination and independence at the same time that it's changing what we thought we knew about the human brain.

Constraint-induced therapy (CIT) helps chronic stroke patients regain near-normal function in hands rendered virtually useless by stroke. The therapy consists of binding the patient's less impaired arm, which forces him or her to relearn how to perform tasks with the hemiplegic hand.

More than 20 years ago, Taub and Wolf (University of Alabama and Emory University, respectively) pioneered intensive CIT programs, in which patients' "good" arms are restrained during waking hours. Therapists then work with these patients six hours a day for two weeks. Such intensive CIT has restored hand dexterity and strength more than two years after stroke.

But many patients don't have the stamina to undergo six hours of rehabilitation each day. Even those who do often run into a brick wall of nonreimbursement—managed care companies don't cover intensive CIT, and few patients can afford the more than $10,000 those programs can cost.

That's why the modified CIT program being introduced at Kessler institutes is so promising. Patients choose specific skills that they want to work on, like writing or using gardening tools. They then attend three half-hour therapy sessions each week for 10 weeks.

At the same time, they keep their less impaired arm bound for five hours a day. According to Stephen J. Page, Ph.D., a Kessler research scientist who helped develop the program, most patients choose the hours between 5 p.m. and 10 p.m.

PHOTOGRAPH BY MICHAEL PLATT

Stroke patient Lou DiBello regained substantial function in his affected wrist and fingers as a result of participation in modified constraint-induced therapy.

"That's a time when they have to prepare and eat a meal, brush their teeth and get ready for bed—do highly functional tasks with their impaired hand," says Dr. Page. "But they can still work, use their canes and carry out their normal lives during the day, which they can't do in intensive CIT."

Modified CIT restores similar levels of grasp, grip and gross motor function as intensive treatments. But because the format is more manageable, it appeals to more patients—and the 30 sessions are covered by many managed care companies as well as by Medicare.

How does CIT work? We once thought that the effects of brain damage were permanent and irreversible, making it impossible to treat chronic stroke patients. But we now believe that the brain can remodel itself, undergoing a process of "cortical reorganization." Different regions of the brain that were not previously linked to a specific movement—and that were not affected by the stroke—begin taking over that movement's control.

As the brain develops, several different neural circuits running between the brain and muscles may learn to control a specific movement. But as that movement is mastered, one of those neuronal pathways becomes dominant and preferred—until it gets shut down by a vascular event. We now believe that CIT may activate those long-dormant "sleeper" pathways, shifting control of a movement away from cells damaged by infarct or hemorrhage to brain regions being recalled by the forced, repetitive use of the affected arm and hand.

This new model of a dynamic brain is also leading us to rethink our current approach to acute rehabilitation. In their first month post-stroke, patients typically are taught how to compensate for hemiplegia by learning to do tasks with their less affected hand, instead of how to work toward restored function in the debilitated one. This approach, we now suspect, just reinforces the "learned non-use" of the impaired arm and hand—a process that CIT can reverse.

While modified CIT has given us excellent results in patients many years after their strokes, it is not a panacea. Therapists can work with patients who have mild sensory as well as motor deficits, but the program is not appropriate for patients whose balance has been affected or who are cognitively impaired. Patients must be able to understand the different components—such as extending and gripping—that

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An Interview with Gerard Malanga, M.D.

The active approach in treating whiplash

Treatment should be more science-based, says the co-editor of a new book on this often controversial injury

Gerard Malanga, M.D., sees whiplash from several angles. He is a physiatrist at the Kessler Institute for Rehabilitation, an associate professor of rehabilitation medicine at the University of Medicine and Dentistry of New Jersey (UMDNJ)—New Jersey Medical School, a past president of the Physiatric Association of Spine, Sports and Occupational Rehabilitation and a consultant to an insurance company. He is also a sports enthusiast.

Malanga, co-editor of a new book titled *Whiplash*, was interviewed recently by *Focus on Rehabilitation*.

MRIs can be useful, but may not be needed in every case, says Gerard Malanga, M.D.

FOCUS: Your publisher says your book heralds a change in whiplash treatment. Is such a change needed?

MALANGA: Yes. Many treatments for whiplash injury are based on physicians' biases and aren't supported by the scientific literature. Treatment is evolving away from passive approaches and toward exercise and reactivation—away from heat, stimulation and other passive modalities toward normalizing activities. I believe treatment is best when patients can actively do things for themselves and understand how they can control their own symptoms.

FOCUS: What will this change mean for the clinician?

MALANGA: While this strategy allows for soft-tissue therapies such as chiropractic and acupuncture, many physicians unfortunately overuse or misuse them. These treatments should be used thoughtfully and for a limited time. They can provide an opportunity for the patient to begin a program of activity. Physicians recommending these treatments should understand how and why they work, what the scientific literature says for and against them, which patients they are right for and what the end point of treatment should be.

FOCUS: How have advances in medicine and technology affected the diagnosis of whiplash injury?

MALANGA: Imaging studies, such as MRI, have helped to better delineate soft-tissue pathology. But they can also lead practitioners astray because of many false-positive findings—that is, "abnormal" findings in people without any complaints, which may convince patients that they are seriously injured when they are not. Therefore, a detailed history and physical examination are essential in the evaluation of patients with whiplash injuries. Physicians should use testing as an adjunct when the diagnosis remains unclear or when patients do not respond to good treatment. Most patients can be managed without a lot of testing.

FOCUS: How does your approach to diagnosis change the way a patient looks at recovery?

Gerard Malanga, M.D., and Scott Nadler, D.O., associate professors in the Department of Physical Medicine and Rehabilitation at the New Jersey Medical School, UMDNJ, created *Whiplash* for the practicing physician, chiropractor or other medical professional. The book focuses on up-to-date diagnostic, therapeutic and preventive measures in the appropriate treatment of whiplash-associated injuries. By providing a comprehensive review of the subject, the editors hope to give clinicians solid information to guide their treatment. The 40 experts who wrote the chapters avoided opinion in favor of information backed by scientific evidence.

Dr. Malanga says the book is also useful for those in the insurance and legal professions who face issues surrounding clients claiming whiplash injuries.

Whiplash is published by Hanley & Belfus (December 2001, ISBN 1-56053-438-9, $45). Its multidisciplinary coverage includes not only biomechanics, pathophysiology, clinical presentation, complications and rehabilitation, but also the legal and psychological context of whiplash injury.

MALANGA: Clinicians can steer patients down a positive path. Just as players in the NFL and NHL, after being hit with enormous force, can come back the next week to play, so too can patients recover quickly. Of course, part of athletes' rapid recovery has to do with fitness and strong muscle groups around the neck, but part of it is mind-set.

I suggest that physicians stick as much as possible to scientific evidence for what they do and be as precise as possible in delineating what is going on. They should foster a mind-set that focuses on getting better and invite patients to take an active role in that process.

Compliance can be greatly enhanced if clinicians educate patients throughout their recovery—making them aware, for example, of any significant findings on the physical examination, what the working diagnosis is, why tests are ordered or not ordered, the rationale for prescribing medications, common side effects of medications, the plan for physical therapy and the expected goals and timing for a follow-up visit.

FOCUS: Whiplash injuries often result in litigation and problems with insurance. How does your approach affect the economic environment?

MALANGA: Having worked closely with insurance companies over the years in reviewing cases involving whiplash injury, I've noticed a great disparity in physicians' diagnoses and in their treatment of patients. I understand the clinical and legal issues involved in such injuries, and I am aware that there is abuse of the system.

Clinicians who use the patient history as the diagnostic tool and who lead the patient down an active, positive path for treatment can help significantly to reduce the waste of healthcare dollars. That may not resolve every problem because of the potentially controversial nature of whiplash injury claims. But such treatment should help to save resources for the seriously injured patients who truly need them. FOCUS

PUBLIC POLICY VIEW

The rules change for facilities—but not for you

Bruce M. Gans, M.D.

The start of 2002 brought an important change in Medicare's payment method for inpatient hospital-level rehabilitation services, and every physician should understand the implications of this change.

Under the old system, based on the Tax Equity and Fiscal Reform Act (TEFRA), rehabilitation hospitals and units were paid essentially on a per diem basis (capped out at a historically established cost base that was different for each facility). This meant that the hospital had an economic incentive to allow patients to utilize their fullest benefits and stay for as many days as they could afford, as long as the total costs did not exceed the TEFRA target. Care for each patient, regardless of the diagnosis, was reimbursed the same.

As of January 1, however, facilities are required to complete within two years a shift to a new Rehabilitation Prospective Payment System (PPS). It will base reimbursement for each patient on the patient's functional status, age and medical complexity. The new system for determining the case-mix-adjusted reimbursement is built on case mix groups, or CMGs, which in turn are derived in part from the functional independence measure (FIM), the *de facto* industry standard for describing a patient's disablement.

Under this new PPS, facilities now have strong incentives to reduce length of stay and resource utilization. The field's experience over the last 10 to 20 years strongly suggests that, in fact, shorter lengths of stay can be associated with similar or improved outcomes for our patients.

Medicare's shift to the PPS will not affect how physicians themselves are paid. Since fee-for-service reimbursement from Medicare is unchanged, shorter lengths of stay may mean reduced revenue per patient admission. On the other hand, more days of care during a hospital stay may be properly billed at higher levels of complexity, due to the accelerated pace of the patient's rehabilitation program.

One thing is certain. Physicians can no longer focus principally on the hospital phase of the patient's rehabilitation when planning their patients' treatment. They must look at the entire episode of care, of which the inpatient component will be just one piece, and help to make sure that each phase of care is provided in an appropriate setting. At Kessler, we now identify at the time of a patient's admission a clear expectation, understood by the patient, of what inpatient treatment should accomplish, along with dates of discharge and the expected start of outpatient treatment.

A final caution. The reimbursement system will create strong pressures on physicians to discharge patients quickly. While our responsibility is to direct patient care programs that are efficient, our obligations are first to our patients, not our facilities. Thus, the physician is still responsible for deciding when the patient is ready to be discharged, regardless of the economic incentives to the hospital. We should lead the way for our hospitals to develop care plans and methods of care delivery that will allow efficient and effective care to be delivered to our patients, but not at the expense of the quality of care our patients receive.

Here at Kessler, we have created care plans and process improvements that we believe help our patients achieve excellent outcomes while utilizing our hospital resources in very efficient ways—without jeopardizing the total rehabilitation potential our patients can realize. FOCUS

Bruce M. Gans, M.D., is the executive vice president and chief medical officer of Kessler Rehabilitation Corporation.

Board certification isn't what it used to be

Joel A. DeLisa, M.D., M.S.

No one has to tell physicians, particularly those in the field of rehabilitation, that change brings new opportunity. Every day our science advances in its ability to restore health and function after illness or injury. But when it comes to changes in the professional organization of medicine, brought on by changes in healthcare, we're apt to become nostalgic for the old days.

Take board certification, for example. When the American Board of Physical Medicine and Rehabilitation (ABPMR) established certification in 1947, it was a permanent credential. In 1993, following a mandate from the American Board of Medical Specialties (ABMS), an umbrella organization, lifelong certification gave way to time-limited certification that had to be renewed every 10 years. The goal was to assure the diplomate's continuing competence in his or her field.

More change is coming. In 1998, the ABMS established a Task Force on Competence to study the relationship between specialty certification and recertification on the one hand, and competence on the other. Behind the move lay growing public concern about physician competence in various fields, triggered at least in part by the public's increasing perception of medicine as a business.

In September 1999, the ABMS approved the following description of the competent physician:

- *The competent physician should possess the medical knowledge, judgment, clinical and communication skills, professionalism and leadership ability to provide high-quality patient care.*
- *Patient care encompasses the diagnosis, treatment and management of medical conditions; promotion of health; prevention of disease; and compassion and respect for patients and their families.*
- *Maintenance of competence should be demonstrated throughout the physician's career by evidence of lifelong learning and ongoing improvement of practice.*

Residency training and the maintenance of certification, the Board said, must involve six general competencies: medical knowledge, patient care, interpersonal skills and communication, professionalism, practice-based learning and improvement, and systems-based practice.

> Smart physicians will climb on the bandwagon of change.

In March 2000, ABMS called on its member boards to "evolve" their programs of periodic recertification into "maintenance of certification" initiatives. That implies that some demonstration of competence will be required at intervals much shorter than the 10-year cycle of current ABPMR certification—or even the seven years favored by boards in some other specialties. It suggests that physicians may soon have to undergo some process—an examination, an educational course, an expert evaluation of their practice—at least annually. The day may even come when board certification is divided into levels, some of which define not a minimum but a truly rare level of excellence.

Of course, time spent renewing credentials is time taken away from patient care or keeping up with the literature. So it is understandable that many physicians' private reaction to this forecast may be, "What a hassle." But that reaction takes too narrow a view. In an era when physicians' human fallibility is the stuff of daily headlines (yet every consumer within hand's reach of a mouse becomes an "expert" courtesy of the Internet), I would say it is part of our challenge as physicians—part of our "communication skills" and "leadership ability," if you will—to be sure that the issue of our competence is approached just as rigorously, and freshly, as our clinical interventions themselves.

In any case, lifelong board certification has gone the way of the hoop skirt and the manual typewriter. And ongoing maintenance of certification is coming whether we like it or not. ABMS says every certifying board's maintenance-of-certification program must find ways to measure four criteria:

- professional standing,
- lifelong learning and self-assessment,
- cognitive expertise and
- practice performance.

How will these things be assessed? What tests, observations, evaluations, self-assessment modules or other tools will be involved? These decisions will be made soon by the ABPMR and other certifying boards. Some physicians will complacently ignore this process; others may try to resist the trend itself. But the smart ones will climb aboard the bandwagon. They will join committees in their specialties to design maintenance-of-certification programs to make sure they represent meaningful professional assessment rather than irrelevancies. They will acknowledge that medicine is becoming more computer-driven and more accountable. And they will even admit that, from the public's perspective, much of that change is good. FOCUS

Joel A. DeLisa, M.D., M.S., is the president of the Kessler Medical Rehabilitation Research and Education Corporation.

Lowering costs and improving outcomes in the prevention of thromboembolism

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parin (odds ratio, 0.160). Three DVT events (1.9 per 100 patients) occurred among patients treated with enoxaparin, compared with one (0.3 per 100 patients) among dalteparin patients. All four DVT events were distal. Of the enoxaparin group, two DVTs occurred in knee patients and one occurred in a hip patient. The sole event in the dalteparin group occurred in a hip patient.

The age-related risk of a bleeding event was slightly smaller among dalteparin patients (odds ratio, 0.634). A total of six (3.7 per 100 patients) bleeds occurred in enoxaparin patients versus seven (2.3 per 100 patients) events for dalteparin patients. All bleeding events were minor and none required transfusion or transfer to an acute care facility.

Dalteparin more cost-effective

Based on the cost analysis of DVT prophylaxis per rehabilitation stay, dalteparin represented a significant savings. The average cost of prophylaxis for a patient receiving dalteparin was $91 less than for a patient receiving enoxaparin ($364 per enoxaparin patient versus $273 per dalteparin patient). After adjusting for patient differences, including length of stay, costs were $129 lower among dalteparin patients.

The acquisition cost for a daily dose of enoxaparin was estimated at $27.95. For dalteparin, the acquisition cost for a daily dose was estimated at $19.92. A pharmacy dispensing cost of $5 per dose was also included in the unit cost for each drug, as were additional costs for adjustments in dosage ($0.004 per additional IU for dalteparin and $0.466 per additional mg of enoxaparin).

> With more than 300,000 joint replacements done each year in the U.S., potential savings are great.

Since these data were analyzed, 500 more patients' records have been collected, and the data from these are consistent with the previous findings.

Implications for future care

With approximately 2,000 joint replacement patients treated each year at Kessler (nearly one third of all patients in the facility), the formulary change to dalteparin for joint replacement patients represents a potential annual savings of $258,000. Additionally, with more than 100,000 total hip replacements and 200,000 total knee replacements done annually in the U.S., the potential savings in national healthcare costs are substantial.

Cost savings in the future may extend beyond those seen with total hip and knee arthroplasty, however. Today, many indications—and therefore many possible areas for cost savings—exist for low-molecular-weight heparins. These include multiple trauma, pelvic fractures, severe stroke caused by embolism, unstable angina and non-Q-wave myocardial infarction. Research is needed to determine whether switching patients with these conditions from enoxaparin to dalteparin will cut costs without compromising patient care. The results of any such research will depend on the dosages required for each indication. For instance, if an indication requires one daily dose of 40 mg enoxaparin, then no savings would be anticipated, since there is no difference in costs between enoxaparin at that dosage and dalteparin 5000 IU. For indications in which a single dose of dalteparin could be used instead of two doses of enoxaparin, on the other hand, research may well indicate potential cost savings.

Switching spinal cord injury patients to dalteparin is another possible area for study, and one project of this kind with 25 patients was conducted at Kessler. However, the sample was too small to permit definitive conclusions, and physicians resisted extending this experimental substitution to additional patients because of the high clotting risk that accompanies this condition. For the foreseeable future, therefore, the largest cost savings achieved by substituting dalteparin for enoxaparin to prevent DVT will undoubtedly be achieved in joint replacement patients. FOCUS

DALTEPARIN VERSUS ENOXAPARIN

	Dalteparin	Enoxaparin
DVT events, per 100 patients	0.3	1.9
Bleeding events, per 100 patients	2.3	3.7
Cost per patient stay	$273	$364

Robert Krotenberg, M.D., is the medical director and senior medical officer of the Kessler Institute for Rehabilitation.

Footnote

1. Krotenberg, R., Adler, U., Pomeranz, B., Miller, J.D., and Russell, M.W. "Dalteparin vs. enoxaparin as prophylaxis for deep-vein thrombosis after total hip and knee arthroplasty: A retrospective analysis." *Am J Phys Med Rehabil,* 2001;80:889-895.

Constraint-induced therapy

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make up a specific movement and be able to follow commands.

CIT candidates also need at least 10 degrees of pre-therapy wrist extension and finger flexion, which makes the program an option for about 20 percent of all stroke patients. New research may soon expand that population to include those who are more severely impaired or in the acute phase of recovery. (Modified CIT is now available to patients who are at least six months post-stroke.)

In the meantime, it is gratifying to see patients recover skills they thought were lost.

"CIT goes a long way to increasing patients' independence," says Sue Ann Sisto, Ph.D., director of Kessler's Human Performance and Movement Analysis Lab, where the modified program was developed. "Since they don't have to rely so much on family members or other caregivers to do everyday tasks, they end up living with a lot less frustration." FOCUS

Ross Bogey, D.O., is the director of stroke research at the Kessler Medical Rehabilitation Research and Education Corporation.

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Clinical Pearls

Prevention, diagnosis and treatment of deep-vein thrombosis after spinal cord injury

Steven Kirshblum, M.D.

In light of the potential morbidity and mortality associated with deep-vein thrombosis (DVT) after an acute spinal cord injury (SCI), it is important to prevent DVT, or to diagnose and treat it as early as possible.

Incidence and prophylaxis: Potential morbidity from a DVT includes severe sustained edema that may be a source of skin breakdown, pain or autonomic dysreflexia, and may cause difficulty with functional activities. The greatest potential problem from a proximal DVT is the development of a pulmonary embolism, a leading cause of death in acute SCI.

After an acute traumatic SCI, the risk of DVT is extremely high without prophylaxis, as all three risk factors of Virchow's triad are present. Prophylaxis is by three mechanisms:

- Mechanical means include pneumatic compression devices worn for 24 hours while the patient is in the acute hospital. If the patient has not started one of these within 72 hours of injury, then a duplex scan needs to be performed before initiating it. Once the patient is in the rehabilitation unit, the use of compression devices for 24 hours is not feasible, as the patient is participating in therapy.
- Pharmacological methods should be started at 72 hours after injury unless there are contraindications present. The use of low-molecular-weight heparin (LMWH) is the preferred method of pharmacological prophylaxis. Continuation depends upon the level and completeness of the injury, but should continue for at least two months. Persons with motor incomplete lesions, even if able to walk, should still be prophylaxed while in the rehabilitation unit or up to two months. It is important to remember that these patients are still at great risk for a DVT early after the SCI, even though they are able to move their legs.
- Surgical prophylaxis includes the use of an inferior vena cava filter. These are currently recommended in patients who have very high cervical levels of injury, cannot be placed on pharmacological prophylaxis (due to gastrointestinal bleed, for example) or have failed chemoprophylaxis. Pharmacological prophylaxis should still be used in patients with high-level injury in whom a filter was placed unless contraindicated for another reason.

Diagnosis and Treatment: At the time of admission to rehabilitation, a duplex scan is recommended to rule out the presence of a DVT, especially if there was not adequate prophylaxis from the acute care hospital. If a DVT is found, current treatment at Kessler includes using Lovenox subcutaneously (at a dosage of 1mg/kg twice a day) and initiating oral Coumadin. The Lovenox is continued until the international normalized ratio (INR) is in the therapeutic range for 24 hours. Coumadin is then continued for six months. If the patient has a filter in place, full anticoagulation is still given so as to prevent the morbidity associated with the DVT. FOCUS

Steven Kirshblum, M.D., is the associate medical director and director of the spinal cord injury program at the Kessler Institute for Rehabilitation.

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