Endoscopists may not be aware of the physical risks to which they are exposed each day as a result of repetitive-use. Repetitive-use, that is repeating motions and actions over and over again as when performing endoscopy, increases one’s risk of sustaining acute musculoskeletal injuries, which ultimately can result in permanent injury and disability. The risks for sustaining injuries from repetitive-use include the duration of activity, the force required to complete the activity, local contact stresses and work postures. The environment in which one works can and does influence injury such as floor surfaces, seating, working heights and over-reaching. Of course injuries occur more frequently in people who are predisposed (one who already has a “bad back” or strained leg muscle), and the injuries are perpetuated by task variability, work rate and work recovery cycles. More commonly, endoscopists complain of low back pain or the recently described “endoscopist’s thumb,” but the entire musculoskeletal system can be affected from head to toes. Symptoms may vary from mild aches and pains to more severe lancinating low back pain to numbness, tingling, atrophy and weakness. These symptoms can result in permanent damage and disability. It is incumbent upon endoscopists and their supervisors to be aware of potential risks, the symptoms and injuries that can result from repetitive-use and to familiarize physicians and their co-workers with techniques to avoid these problems. Those who become injured should seek medical attention early to prevent permanent injury. Repetitive injuries are serious, but they can be prevented.

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Many gastroenterologists might not have considered becoming endoscopists if they had known beforehand that performing endoscopy might contribute to their becoming physically disabled (Table 1). Our awareness of repetitive-use injuries affecting endoscopists is recent, but permanent damage from mechanical stress to the musculoskeletal system from injuries acquired while performing repetitive activities has been well known in stenographers and typists, carpenters, athletes, and musicians. With the increasing volume of endoscopies, including complex therapeutic procedures, that are being performed today compared with that of years passed, we are now increasingly aware of repetitive-use injuries, in part, perhaps, facilitated by the aging of the physician population, which may be more predisposed to injury, such injuries, if not prevented, can progress and become incapacitating. Endoscopy is a demanding skill that is accomplished only by the use of repetitive motions, eg, manipulating the instruments by pushing, pulling, applying torque, and turning control knobs. As with other occupations, these repetitive motions place a strain on our musculoskeletal systems that, if continued, can result in chronic inflammation with resultant progression to permanent damage (Table 2). These injuries can compromise one’s physical abilities from simply not being able to stand upright to losing one’s fine motor movements (Table 3). Inevitably, one’s professional career may be seriously affected from these permanent injuries incurred from one’s work habits.

There is a misconception that physicians, in general, and endoscopists, specifically, need not be physically fit to perform their professional duties. To the contrary, endoscopists should be more cognizant of their physical strength and endurance. Because endoscopy is labor intensive, endoscopists should be fit. Because of the physical activity associated with endoscopy, the practitioner should maintain a normal body habitus, exercise regularly, stretch daily, and maintain good cardiopulmonary function. These precautions can enable endoscopists to avoid potential injuries which could occur from: (1) moving patients about; (2) manipulating endoscopes for extended periods; (3) twisting control dials; and (4) standing for long periods.

In this article, I will describe the injuries reported to occur.
Anatomy of Injuries

Musculoskeletal injuries affect a variety of tissues including bones, joints, cartilages, ligaments, tendons, muscles, and other soft tissues. A single incident, such as attempting to lift or move a patient from a stretcher when one’s posture is compromised, can lead to chronic problems. Once an injury has been sustained, either at work or from other activities, such as sports, the repetitive motions required to perform routine endoscopic procedures may continue to aggravate the index injury and compromise one’s physical abilities. Repetitive-use injuries result from:

1. Forceful movements (eg, moving a sedated or uncooperative patient)
2. Rapid movements (eg, advancing and torquing instruments)
3. Advancing stents
4. Rotating the thumb and index finger to adjust tip deflection of the endoscope and
5. Static loading injuries (fixed posture without support, eg, standing in an awkward position while supporting an endoscope)

In the recent past, few studies were dedicated to determining the types of injuries sustained by endoscopists. In 1994, Buschbacher surveyed 300 endoscopists and discovered that a significant number had sustained musculoskeletal injuries from performing endoscopic procedures, some of which compromised or ended their careers.7 This survey revealed that:

1. 32% of endoscopists complained of carpal tunnel syndrome
2. 27% suffered from back pain
3. 19% had thumb pain
4. 15% had elbow pain and
5. 13% had neck pain

Interestingly, 66% of the respondents said they had pain whether they were working or not, 56% were troubled by pain when they were performing endoscopy or other work-related activities, and 42% said they suffered when they were performing endoscopy. Because of these work-related injuries, 8% of endoscopists who completed this survey had to reduce their endoscopy workload, 2% eliminated endoscopy from their practices, and 4% retired because of their chronic problems.

In a recent prospective, controlled study (reported from the Mayo Clinics at the 2007 DDW) endoscopists were matched with Internal Medicine specialists to compare the incidence of injuries resulting from their different occupations. Endoscopists reported a larger number of musculoskeletal problems than did Internists.8 Of the 63% respondents from Gastroenterology, the most frequently reported injury was the “Endoscopist’s Thumb,” experienced by 19% of endoscopists. This injury results from the repetitive rotation of the left thumb, which is necessary to adjust or angulate the distal tip of the endoscope.9 A
total of 17% of the respondents reported injuries to their hands, 12% complained of back problems, and 12% complained of neck injuries.

**Neck and Shoulder Syndromes**

With the introduction of video endoscopy, one would expect neck and shoulder injuries to occur less frequently, because the physical strain of having one’s head applied close to the optical end of a fiberscope has virtually been eliminated. With video endoscopy, however, we should ensure proper placement of the video monitors to avoid hyperextending our necks. The height of the monitors should be adjustable to each endoscopist’s eye level, thereby preventing unnecessary strain on our necks by avoiding cervical hyperextension. If one has degenerative changes affecting the cervical spine, hyperextending the neck could compress the spinal cord, producing paresthesias and numbness. Endoscopists who began their careers using optical endoscopes are older and likely have comorbid age-related conditions, such as degenerative arthritis, which may predispose them to cervical spine injuries from repetitive use. Optical instruments required the operator to hold the operating-end of the endoscope in his/her left hand. The operating-end of the endoscope contained the eyepiece, which, at the same time as endoscope manipulation was occurring, had to be secured against the endoscopist’s eye. To accomplish this, the operator’s neck had to be flexed forward. When the operator moved the endoscope, his/her head moved with the endoscope, producing chronic neck strain. These repetitive actions required the endoscopist to twist his/her neck and flex his/her head forward while simultaneously grasping and holding the upper portion of the endoscope with the left hand, turning the up–down angle controls with the left thumb and index finger, maneuvering the elevator to control the movement of the accessories with the left thumb, and simultaneously torquing the endoscope with the right hand while manipulating the accessories. Add the additional weight of a lead apron for endoscopic retrograde cholangiopancreatographies (ERCPs), moving one’s feet from the fluoroscope pedal to the electrocautery pedal while maintaining a stable position; all this for at least an hour for each case. With these repetitive activities, endoscopists developed neck and shoulder pain, arm pain, numbness in the upper extremities, and discomfort or pain in the lower back. Many endoscopists (and other subspecialists, such as urologists, orthopedists, and plastic surgeons) have experienced similar cervical spine and neck injuries, some requiring surgery. In a report in *Endoscopy*, we described a serious neck injury, which affected this author and required urgent surgery.10 Because of the repetitive activity required to perform ERCPs with optical instruments for years, I developed degenerative changes of the cervical spine that resulted in spinal cord damage at the C3–C5 levels, producing a myelopathy, which seriously compromised my arm and leg strength, fine motor function, and gait. Fortunately, my response to surgery, which included diskectomies, fusion and bone grafts, and insertion of a Titanium plate, was good and, after undergoing intensive physical therapy and avoiding repetitive activity during a long convalescence, I returned to performing ERCPs (Fig. 1).

Other shoulder problems, such as a rotator cuff injury or bursitis, may not have been a direct consequence of repetitive use from endoscopy, but, for example, if such an injury occurred during a sporting activity, often it is aggravated by the repetitive motions used during endoscopy and can compromise the endoscopist’s effectiveness to rotate, torque, and advance the instrument.

**Ulnar and Radial Nerve Entrapment Syndromes**

Some endoscopists have experienced paresthesias in their dominant arm, which emanates from their elbows and may be secondary to either ulnar or radial nerve entrapment. More commonly, bone spurs in the ulnar groove compress the nerve producing symptoms, especially when the person is required to use that arm while performing repetitive activities. With repetitive use, inflammation ensues, increasing the compression, pinching the nerve, producing paresthesias, and inhibiting full range of motion. This problem usually responds to conservative measures such as rest or immobilization, using a sling or cast, and taking antiinflammatory medication. If unresponsive, these problems may require surgery. Surgery entails moving the ulnar nerve from its position in the ulnar groove of the elbow to the adjacent soft tissue. Fortunately, my ulnar nerve compression syndrome responded to conservative treatment.

**Wrist and Hand Injury**

Many of us are familiar with the most common injury affecting the wrist or hand: the carpal tunnel syndrome. This syndrome is well described as an occupational injury affecting many people in the work place, but until recently, this syndrome was not appreciated or reported by endoscopists as a...
work-related injury. It results from repetitive rotation and torquing activity of the wrist and hand during endoscopy. The median nerve traverses the underside of the wrist through a tunnel surrounded by bone and fibrous tissue. The tissue overlying this region can become inflamed as a result of repetitive activity, thus constricting the median nerve. Swelling of these tissues leads to nerve entrapment producing pain, weakness, numbness, and paresthesias. Rest is paramount in treating this condition, but surgery may be necessary to relieve compression of the medial nerve. Another problem, which occurs less frequently, is Dupuytren’s contracture. This entity has been included in the list of hand injuries resulting from repetitive activities, but the cause of this deformity remains questionable.

Low Back Pain and Lumbosacral Spine Disease

Most endoscopists are not aware that the backache they feel after a day of performing endoscopic procedures is the result of continuous or repetitive trauma to the lumbosacral spine, especially from standing in awkward positions without proper back support during the work day. Most endoscopists contort their bodies and backs to conform to the demands of standing and working in awkward positions. For ERCP and placement of esophageal stents, there is the additional burden of wearing a lead apron. As mentioned above, moving patients when the back is poorly supported is one cause of backache, but standing in one position all day leads to repetitive trauma to the lumbosacral spine. The ligaments supporting the back become stretched or shortened because of our posture, and this leads to abnormal tensions on the spine, which can produce permanent deformities (Fig. 3). These actions can result in herniated discs, which may require surgical repair. Again, conservative treatment of these problems is recommended, which requires rest, intensive physical therapy, and use of antiinflammatory medication.

Endoscopist’s Thumb and Finger

The injury known as “The Endoscopist’s Thumb” has been detailed in a recent report and was described above.11 This injury results from repetitive use of the endoscopist’s left thumb, which is essential to turn the dials that control the angulation of the distal tip of the endoscope. It is difficult to prevent this injury unless the endoscopist changes his/her techniques for controlling the up–down and right–left movements of the endoscope. We are more cognizant of this injury now, because of the increased demand for screening colonoscopy, which has increased the volume of procedures, thereby placing more strain on affected joints. If the endoscopist takes the pressure off the left thumb and modifies the one-handed method with the two-handed technique to turn the dials, one can rest the affected thumb and allow the thumb to heal. Additional treatment includes rest, immobilization with splints, taking antiinflammatory medication, and injecting steroids into the affected joint.12 Certainly the two-handed technique can prevent this injury, but it is not as efficient as the one-thumb technique.

I have previously described another finger injury that affected the metacarpophalangeal joint of my right index finger (Fig. 2). This injury is rare, but I attribute it to the repetitive use required in pushing stents or prostheses thousands of times. To push a stent, the endoscopist must grip the pusher catheter tightly. This tight grip repeated many times can result in trauma to the joint of the index finger. In this case, the joint has remained permanently enlarged but functional and without pain.

Figure 2  Metacarpal–phalangeal joint of index finger of right hand, permanently deformed from repetitive use “pushing” stents.

Figure 3  CT scan of lumbosacral spine of an endoscopist showing severe degenerative changes.
Injuries to the Hips, Knees, Legs, and Feet

Obviously, if we stand in one place contorting our bodies to perform endoscopic procedures, we are at risk of injuring our supportive musculoskeletal system. If we injure our backs, we compensate by changing our position to relieve the discomfort, and, in so doing, we aggravate the inflammation by transferring the injury to our hips, knees, legs, and feet. Sciatica manifests as lancing pain caused by compression of the nerve root, usually from a bulging disc, which is transferred from the lumbo-sacral spine into the affected hip and leg. Additionally, as a result of our active lifestyles, hip and knee injuries are very common. When we add to these injuries our labor intensive, repetitive activities, our hip and leg problems may become prolonged or chronic. Again, rest, physical therapy, and antiinflammatory medication are recommended.

Leg and Foot Pain

Most leg pain that we experience is transferred pain from our backs or hips. Unless one has sustained leg trauma, leg pain should not be a common complaint among endoscopists. Standing for long periods may predispose an endoscopist to phlebitis, especially since varicose veins occur frequently when we remain in static positions. Foot injuries may include plantar fasciitis, which has been associated with standing for long periods. Additionally, the fascial planes of the foot are rich with tendons and synovial tissues, which can become inflamed and swollen as a result of standing or maintaining static positions for long periods. This trauma results in compression injuries to the supporting structures of the foot. Rest and antiinflammatory medications, and steroid injections into the affected fascia or affected areas may provide relief. Sometimes, using orthotics may relieve foot symptoms, but the endoscopist should consult with a specialist before changing his/her shoes and using inserts.

Prevention

Most injuries can be avoided if we are aware of the risks associated with repetitive use. Modifying one’s activities, correcting one’s posture, and avoiding awkward and abrupt movements, especially when one’s body or back is unsupported, will avoid acute injury. It is best to avoid overworking when one already has an injury because repetitive use commonly will aggravate an underlying problem. Correcting one’s posture, moving about instead of remaining static, and supporting one leg on a short stool will help to reduce static pressures and alternate the weight placed on either leg. Take breaks and change your position. Be cognizant of potential risks. As mentioned above, it is important that doctors and nurses remain physically fit, incorporating both aerobic and anaerobic exercises into their fitness regimens. Daily body stretches are important, particularly stretching the muscles that remain static during endoscopy, such as the hamstrings, back, and neck. Yoga is an excellent technique for improving body strength as well as enabling one to remain calm. Ergonomic modifications of the endoscopy unit are critical. In our unit, we replaced one of the systems we use for ERCP with ergonomically adjustable and articulated armatures for the monitors. Our endoscopy tower was suspended off the floor, also on adjustable armatures. Each endoscopist can adjust the fluoroscope monitor, the video monitor, and the tower to his/her own height and move the tower so as to be more comfortable. In addition to using a short stool on which one can rest his/her foot, the floors can be modified with rubber pads, which will help reduce trauma to the legs and back. And for those performing ERCP, wearing a lightweight apron or two-piece apron will reduce the extra weight load on the back and neck. Most importantly, remain fit and maintain a normal body mass index. The problems incurred at work are serious and can compromise one’s career. Take them seriously.

References

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