CLINICAL THERAPEUTICS

Uterine Fibroid Embolization

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This Journal *feature begins with a case vignette that includes a therapeutic recommendation. A discussion of the clinical problem and the mechanism of benefit of this form of therapy follows. Major clinical studies, the clinical use of this therapy, and potential adverse effects are reviewed. Relevant formal guidelines, if they exist, are presented. The article ends with the authors' clinical recommendations.*

A 45-year-old, premenopausal black woman (gravida 3, para 2, with a history of one spontaneous abortion) presents with menorrhagia and dysmenorrhea that has worsened progressively over a period of 10 years. She does not wish to have any more children. On physical examination, she has a firm, nontender, enlarged uterus. The ovaries are not palpable. Laboratory tests in the past had revealed intermittent mild anemia that was correctable with iron supplementation, but more severe anemia has been noted recently, and she has had increasing difficulty managing her menstrual bleeding. In-office ultrasound examinations have shown several intramural uterine masses consistent with uterine fibroids that have been slowly increasing in size; the largest measures 6.5 cm at the point of its greatest dimension. The adnexa are normal. The patient's gynecologist has recommended a hysterectomy. However, the patient does not want to undergo a hysterectomy, and her gynecologist suggests uterine fibroid embolization as an alternative. She is referred to an interventional radiologist who orders a magnetic resonance imaging (MRI) scan. The results of the MRI confirm the ultrasound findings and rule out adenomyosis. The interventional radiologist discusses with the patient uterine fibroid embolization as an alternative to hysterectomy. What treatment should be recommended for this patient?

THE CLINICAL PROBLEM

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Uterine fibroids are among the most common tumors of the female reproductive tract that occur in premenopausal women. In one study of women 17 to 44 years of age undergoing tubal sterilization, fibroids were found in 9% of whites and 16% of blacks,[1] although the prevalence is much higher on pathological examination after hysterectomy.[2] The overall incidence has been reported to be 29.7 per 1000 patient-years, with considerable variation according to age[3]; in most studies, the peak incidence has been shown to occur among women who are in their early to mid-40s.[4,5] The risk of having fibroids is higher by a factor of three among blacks than among whites.[6]

Although uterine fibroids are benign, they can cause considerable symptoms. The most frequent symptom is menorrhagia, with iron-deficiency anemia often occurring as a result. Dysmenorrhea, pelvic pain and pressure, dyspareunia, urinary frequency and urgency, and other pelvic symptoms may occur. Symptoms are often of sufficient severity to necessitate surgical intervention. Fibroids are the most common indication for hysterectomy in the United States; a total of 300,000 hysterectomies to remove fibroids are performed each year. The overall cost of treating fibroids was estimated at $2.1 billion in 2000.[7] More than 70% of those costs were directly related to hysterectomy.

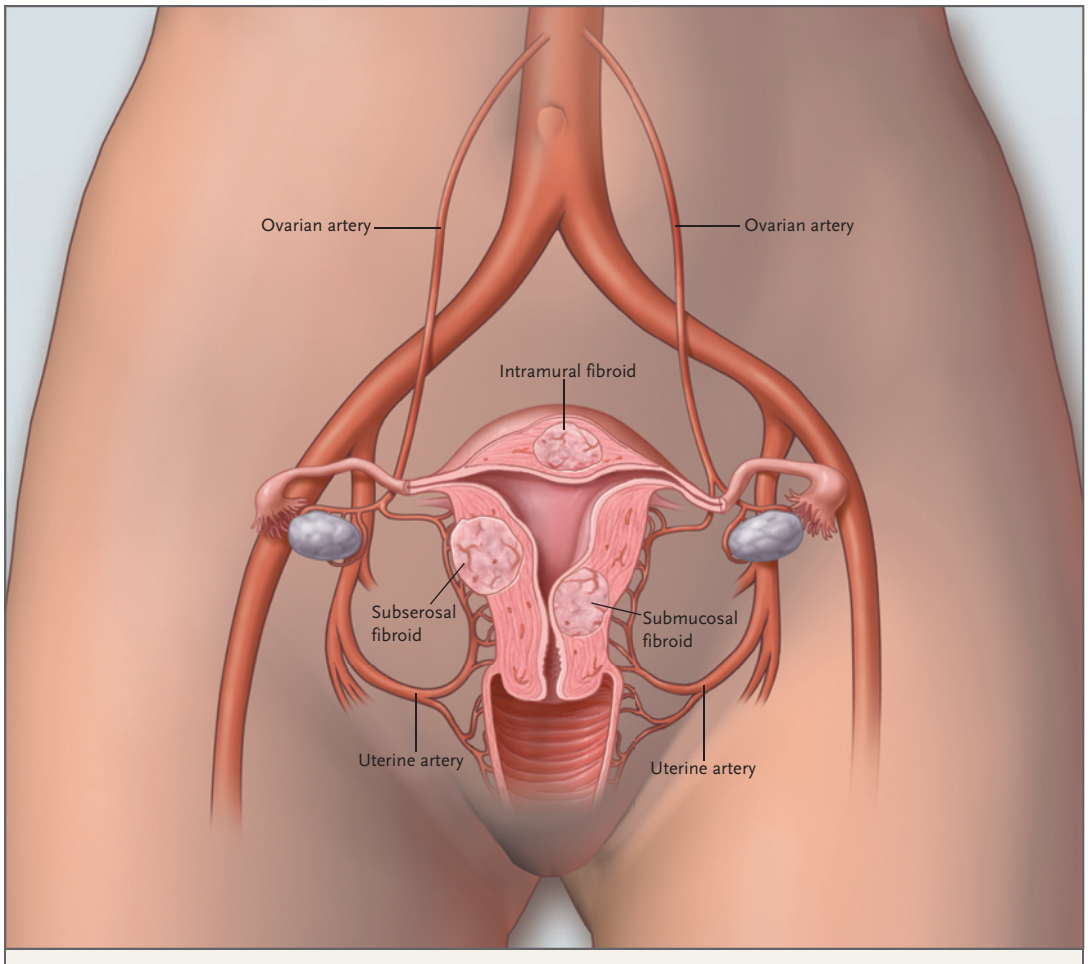

Figure 1. The Vascular Anatomy of Uterine Fibroids.

Most fibroids receive their blood supply from the uterine artery, which is a branch of the internal iliac artery. Additional supply from the ovarian artery is present in 5 to 10% of cases, and anastomoses between the left and right uterine arteries and between the uterine and ovarian arteries are not rare.

STRATEGIES AND EVIDENCE

Uterine leiomyomas are benign monoclonal tumors of the uterus composed of smooth muscle cells and an extracellular matrix of collagen, fibronectin, and proteoglycan.[8] It is not known what initiates fibroid genesis, although it is clear that the growth of fibroids is affected by the presence of estrogen, progesterone, and a variety of growth factors.[9] A role for gonadal steroids is suggested by the fact that fibroids are not seen in children and tend to regress after menopause.

As they grow, fibroids cause enlargement of the uterus. Fibroids that are located in a submucosal position, as well as intramural fibroids that abut the endometrial lining, are associated with heavy menstrual bleeding,[4] whereas the presence of large fibroids or the overall enlargement of the uterus is associated with local pressure, pain, or compressive effects.

Most fibroid tumors receive their blood supply from the uterine artery (Fig. 1). Perfusion from the ovarian artery is seen in 5 to 10% of cases. Anastomoses between the left and right uterine arteries occur in about 10% of patients, and between the uterine and ovarian arteries in 10 to 30%.[10] The tumor is typically surrounded by a dense arterial plexus, whereas the center of the fibroid itself is relatively hypovascular.[10]

Uterine fibroid embolization is a percutaneous

procedure that results in the occlusion of the perifibroid vessels and ischemic infarction of the fibroid.[11] The treated fibroids shrink over the course of several months to years.[12] As a result, symptoms associated with the presence and growth of the fibroids are reduced. Incompletely infarcted fibroids may increase in size again; new fibroids may also develop over time.[12,13] However, in general, a successfully treated fibroid will be permanently devascularized. Pathological studies of uteruses after embolization typically show hyaline necrosis or coagulative necrosis of the tumor mass.[14,15]

Since 1997, when uterine fibroid embolization was introduced into practice in the United States,[16] a number of large observational studies have been performed.[17-21] These studies have shown that menorrhagia is improved in 85 to 95% of patients, and similar rates of improvement have been noted with respect to pelvic pain, pressure, and urinary symptoms.

The Uterine Artery Embolization (UAE) versus Hysterectomy for Uterine Fibroids trial (EMMY; ClinicalTrials.gov number, NCT00100191) was a multicenter, randomized trial in which uterine fibroid embolization was compared with hysterectomy among 177 patients in the Netherlands.[22,23] Patients in the embolization group had a more rapid recovery and a shorter hospital stay than those in the hysterectomy group (2.7 vs. 5.1 days in the hospital), but were more often readmitted to the hospital (11.1% vs. 0%). Both groups had substantial and similar improvements in health-related quality of life, and similar proportions of patients considered themselves to be at least "moderately satisfied" with the outcome at 24 months (92% in the embolization group and 90% in the hysterectomy group). Patients who had undergone a hysterectomy were more often "very satisfied" with the outcome than those who had undergone embolization (45% vs. 34%), and 24% of the patients who had undergone embolization had a recurrence of symptoms that subsequently necessitated a hysterectomy.

The Randomized Trial of Embolization versus Surgical Treatment for Fibroids (REST; Current Controlled Trials number, ISRCTN23023665) was a multicenter study of 157 patients in the United Kingdom who were randomly assigned to either surgery (hysterectomy or myomectomy) or embolization.[24] The investigators found no differences in health-related quality of life between the two groups after treatment, although women in the surgical group reported a greater reduction in symptoms. More major adverse events occurred in the surgical group than in the embolization group during the initial hospital stay, whereas the reverse was true after discharge. With a median follow-up of 32 months, the likelihood of reintervention was much higher among the patients who underwent embolization than among those who underwent surgery (20% vs. 2%, $P<0.001$). Ten interventions occurred among patients in the embolization group in the first year, presumably owing to a failure of embolization to relieve symptoms, and 11 occurred during the subsequent follow-up period. Another long-term study showed that by 5 years after treatment, 20% of patients who had undergone embolization required reintervention.[25]

TREATMENT

Treatment for uterine fibroids is generally indicated only when symptoms are present that are severe enough to be unacceptable to the patient. There is no evidence that women with no symptoms or with mild symptoms benefit from intervention. Exceptions may include women with severe anemia or with hydronephrosis due to ureteral obstruction.[26,27]

Medical therapy is useful in some patients with symptomatic fibroids. Acetaminophen and nonsteroidal antiinflammatory drugs (NSAIDs) are often effective for the relief of pain associated with fibroids, although these drugs do not reduce bleeding. A variety of hormonal therapies, including androgenic steroids, mifepristone, and gonadotropin-releasing hormone agonists and antagonists, have been shown to reduce uterine volume and bleeding. However, most of these treatments have not been evaluated in randomized trials, and in many cases the benefits of hormonal therapy do not appear to be sustained over the long term.[26,27] In addition, many patients do not want to consider taking hormonal therapy or do not tolerate it well.

For patients requiring interventional treatment, the principal current options include hysterectomy, myomectomy, endometrial ablation (when menorrhagia is the primary indication and endometrial anatomy is appropriate), and uterine fibroid embolization. Selection among these procedures depends on the patient's age, symptoms,

coexisting conditions, and reproductive plans, as well as the specific characteristics of the fibroids.[26,27] A thoughtful discussion of the options with an experienced specialist is essential in choosing the most appropriate treatment for a given patient.

Uterine fibroid embolization is a reasonable option for most patients in whom intervention is considered to be appropriate. There is some evidence that patients with larger single fibroids and larger uteruses may have less improvement and less satisfaction with the results[20,28]; in our experience, most patients will have substantial improvement if the size of the uterus on examination before the procedure is no larger than the size of the uterus at 22 to 24 weeks' gestation (2 to 4 cm above the umbilicus). There are some fibroids with locations or morphologic features that appear to make them less-than-ideal candidates for embolization, including broad-ligament fibroids, cervical fibroids, narrow-based pedunculated fibroids, and intracavitary fibroids. However, this perception is based primarily on clinical experience, and little evidence from systematic studies is available to support it.

There are few contraindications to uterine fibroid embolization. Pregnancy, suspected pelvic cancer, active infection, or indeterminate endometrial or adnexal abnormalities requiring further evaluation are clear contraindications. The procedure may be performed in many patients who might be poor risks for surgery, including women who are obese, those who have had previous pelvic surgery, and those who have severe anemia or other major coexisting conditions. Uterine fibroid embolization does not appear to be the most appropriate choice for women who wish to become pregnant in the future (see Areas of Uncertainty).

All women should undergo a thorough gynecologic evaluation and pelvic examination before the procedure. In addition, imaging of the uterus by ultrasonography or MRI is necessary to evaluate the size, location, and number of fibroids. Laboratory tests that are performed before the procedure typically include a complete blood count, coagulation studies, a metabolic panel, and a pregnancy test.

Uterine fibroid embolization should be performed by an appropriately trained and experienced professional, usually an interventional radiologist.[29,30] The procedure is a percutaneous angiographic technique performed in a radiographic suite with the use of video fluoroscopic imaging. The patient is usually sedated during the procedure. A small-bore primary angiographic catheter is inserted into the common femoral artery and is advanced with the use of a guidewire over the aortic bifurcation and into the opposite hypogastric artery. The primary catheter or a smaller-bore microcatheter placed through the primary catheter is then advanced into the uterine artery and typically placed in the distal transverse artery. An arteriogram is obtained to visualize the anatomy of the arterial plexus supplying the fibroid (Fig. 2A). Embolization is then performed with the use of particulate embolization material. Commonly used embolic agents include polyvinyl alcohol particles, trisacryl gelatin microspheres, and gelatin sponge. The embolic material is injected and is carried by the arterial blood flow to the vessels feeding the fibroid. These vessels are preferentially occluded since they are larger and have a higher flow than normal myometrial branches. The procedure is terminated when the fibroid blood supply is occluded but there is still sluggish flow in the uterine artery (Fig. 2B). The catheter is then moved to the ipsilateral hypogastric artery, and the procedure is repeated in the opposite uterine artery. After the procedure, the patient is usually admitted to the hospital for 1 night, for observation, often on a designated interventional radiology service.

For several hours after the procedure, most patients have moderate to intense pelvic pain that requires treatment with intravenous narcotics and NSAIDs. In one study, the mean score for severity of pain on a visual-analogue scale that ranged from 0 to 10, in which higher numbers indicated greater pain, was 3 during the first 24 hours and 4.9 during the first week after treatment.[31] However, the severity can vary considerably; about 20% of women had a score on the visual-analogue scale of more than 7 during the first week. Patients also typically have malaise, fatigue, and myalgias for several days. About a third of patients have a mild fever, with only 2% having a temperature of more than 38.5°C. Most patients return to work and other normal activities within 7 to 14 days after the procedure.

Many patients will have light vaginal bleeding, spotting, or a brownish vaginal discharge for several days, often until the first menstrual cycle.

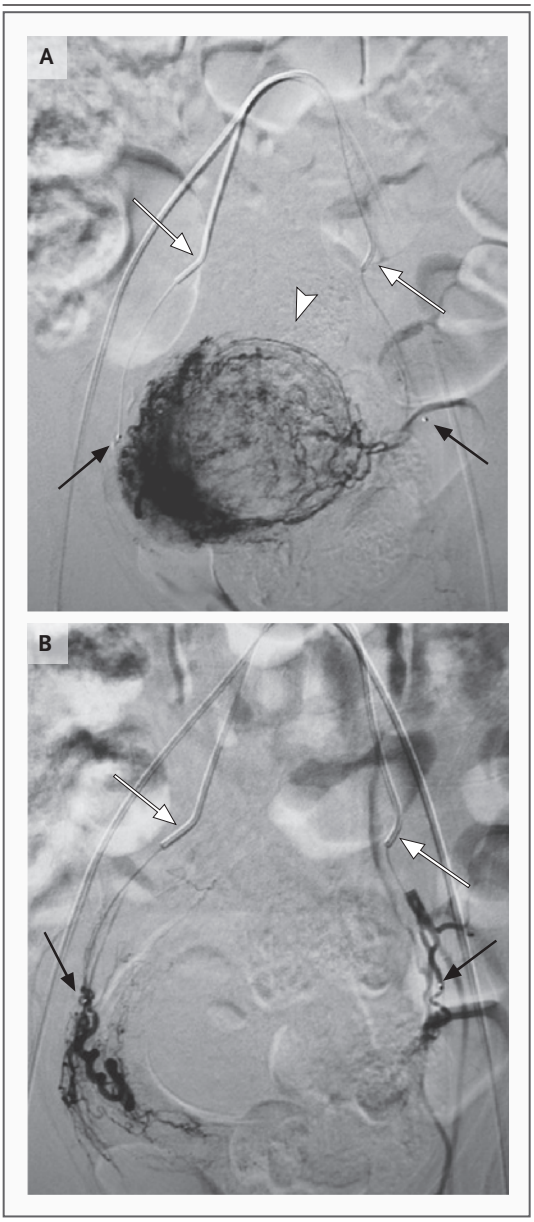

Figure 2. Uterine Fibroid Embolization.

Panel A shows the perfusion of a uterine fibroid before embolization. Two vascular catheters are shown, inserted through the left and right femoral arteries and crossing to the contralateral internal iliac arteries. The tips of these catheters are marked with white arrows. Microcatheters are inserted through the bore of the primary catheters and are advanced to the distal transverse uterine artery. The tips of these microcatheters are marked with black arrows. The blood supply of the fibroid (the spherical structure indicated by the white arrowhead) is provided primarily through enlarged circumferential branches from the left and right uterine arteries. The more uniform intense contrast enhancement on the right is typical of normal myometrium. Although the embolization procedure is usually performed with sequential, rather than simultaneous, catheterization of the two uterine arteries, this image shows the bilateral nature of fibroid perfusion. Panel B shows the same uterine fibroid after embolization. The tips of the primary catheters (white arrows) and microcatheters (black arrows) are unchanged. The arterial branches supplying the fibroid tumor have been occluded by embolic material injected through the microcatheters.

There may be some short-term menstrual irregularity, but most women will resume regular menstrual cycles within 2 to 3 months after treatment. Among patients who had had menorrhagia before the procedure, menstrual bleeding is usually reduced by the second or third menstrual cycle.[32] Pelvic pain, dysmenorrhea, pressure, and urinary symptoms are reduced on a similar timetable, and by 3 months after the procedure, most patients will have relief of symptoms.[19,33]

In a study in which data were collected from the database of several national claims payers in the United States, the mean cost of uterine fibroid embolization was $8,293. This figure included hospital and physician charges.[34] The mean total cost over the first year was $13,270; this amount included subsequent procedures, imaging, medications, and hospital and office visits.

ADVERSE EFFECTS

In a registry of 3160 women undergoing uterine fibroid embolization, major complications (as defined by the Society of Interventional Radiology Clinical Practice Guidelines) occurred in 0.66% of registrants during the initial hospitalization and in 4.8% during the first month after the procedure.[21] More than half of these complications consisted of persistent or recurrent pain or nausea. In a single-center study of 400 consecutive patients, the event rate for major complications was 4.3% during the first year.[35]

The most common constellation of symptoms during recovery is postembolization syndrome, which consists of pelvic pain, fever, and malaise. The syndrome can usually be managed with analgesics and antipyretic agents, although more severe symptoms may require prolonged hospitalization or rehospitalization. It is important to distinguish this syndrome from infection, which is a less common complication, but one that can be serious.

No deaths have been reported in any of the large clinical studies.[19,21,35,36] There have been

two case reports of death due to infection.[37,38] One letter to the editor describes a death due to systemic nontarget embolization in a woman with uterine arteriovenous shunting and patent foramen ovale.[39] Although there are no other published reports of deaths, we are aware of an unpublished report of one death due to a pulmonary embolus.[40]

Pulmonary embolism was reported to occur in 1 in 300 patients in one study.[41] This phenomenon appears to be related to transient hypercoagulability — similar to that seen after surgery, although usually less severe.[42]

Transcervical expulsion of a fibroid or of fibroid tissue occurs in 2.2 to 7.7% of women after uterine fibroid embolization, and in some cases surgical extraction may be necessary.[36] Fibroid expulsion can be associated with endometrial or fibroid infection, although not invariably. Minor infection, whether in the context of fibroid passage or not, occurs in approximately 5.9% of patients, whereas major infection, sometimes necessitating surgery, occurs in 2.6% of patients.[36] Prophylactic antibiotics are routinely administered during embolization to reduce the risk of subsequent infection.[43]

Transient or permanent amenorrhea has been reported as a result of partial nontarget embolization of the ovaries and subsequent reduction in ovarian reserve. Amenorrhea is seen in 2 to 5% of women; permanent amenorrhea occurs in less than 2% of women, nearly all of whom are of perimenopausal age.[36] Other nontarget embolic complications have been very rare and include damage to the buttock[44] or to the bladder or adjacent structures.[45,46]

AREAS OF UNCERTAINTY

The primary unresolved question with respect to uterine fibroid embolization is its effect on future pregnancy. It was mentioned above that ovarian function may infrequently be impaired after the procedure. It might also be anticipated that embolization could influence the endometrium and embryo implantation, as well as the course of pregnancy. In one series of 56 pregnancies after embolization, 17 ended in miscarriage. Of the 33 live deliveries, 24 were by caesarean section. There were 6 cases of postpartum hemorrhage.[47] Placental abnormalities such as placenta previa or placenta accreta may contribute to an increased risk of bleeding and may, in some cases, lead to hysterectomy.[48]

Recently published data from a randomized study involving women in Prague, Czech Republic, provide a basis for comparison of the effect of embolization and myomectomy on reproduction. The investigators enrolled 121 patients, 63 of whom were randomly assigned to myomectomy and 58 to embolization.[49] At the time of the report, 40 women had tried to conceive after myomectomy and 26 after embolization. As compared with women who had undergone myomectomy, women who had undergone embolization had a higher relative risk of not conceiving (relative risk with embolization, 2.22) and of having a spontaneous abortion (relative risk, 2.79). These results favor myomectomy for women who are interested in conceiving in the short term (up to 2 years after the procedure). Longer-term outcomes with respect to reproduction are not yet available.

GUIDELINES

The American College of Obstetricians and Gynecologists (ACOG) concludes "based on good and consistent evidence (level A)" that "uterine artery embolization is a safe and effective option for appropriately selected women who wish to retain their uteri."[50] The ACOG also recommends caution when considering embolization in women who desire to retain their ability to conceive, because age-related amenorrhea can occur in a small minority of patients and because there is a possibility of abnormal placentation. The Society of Interventional Radiology and the Cardiovascular and Interventional Radiological Society of Europe state that uterine artery embolization "is indicated for the presence of uterine leiomyomata that are causing significant lifestyle-altering symptoms, specifically mass effect on the bladder or intestines, and/or dysfunctional uterine bleeding that is prolonged, associated with severe dysmenorrhea, or is causing severe anemia."[51]

CONCLUSIONS AND RECOMMENDATIONS

The patient described in this vignette has symptoms that are clearly referable to her fibroids, and the fibroids are anatomically appropriate for treatment with embolization. She does not have

any contraindications to the procedure. She is not interested in having more children and is seeking a less invasive treatment than hysterectomy.

It is important that the patient have the opportunity to discuss her treatment options with a physician who can explain the relative risks and benefits (ideally with an expert who has experience with the clinical outcomes). Since her symptoms have been steadily worsening for 10 years, it is unlikely that conservative therapy will be acceptable to her, but this option should be mentioned. Hormonal therapies may also be appropriate to discuss, although it is not clear that they provide sustained benefit. In selecting between hysterectomy and embolization, the patient should be told that recovery is more rapid and early complications are fewer with embolization, but that she has approximately a 20 to 25% chance of requiring subsequent invasive intervention. For this patient, who would like to avoid hysterectomy, uterine fibroid embolization would be an appropriate choice.

No potential conflict of interest relevant to this article was reported.

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DR. LAUER REPLIES: Applegate et al. argue that radiologists are most knowledgeable about the effects of ionizing radiation, and they call for stricter accreditation and credentialing standards. Although such efforts may well decrease radiation exposure in the population, they would not provide the high levels of evidence needed to ensure that the use of imaging tests leads to improved patient outcomes.

Becker and colleagues cite a survey of internists as evidence that most imaging procedures yield value, and in doing so these newer procedures convert common old practices to "relics" such as bloodletting. Expert opinion, such as that derived from physician surveys, is the lowest form of clinical evidence.[1] Indeed, medical history is replete with examples of questionable practices that leading physicians promoted contrary to existing evidence.[2] Benjamin Rush and William Osler were strong supporters of bloodletting. More recently, despite expectations, CT scanning has failed to reduce the rate of false diagnoses among patients with suspected appendicitis.[3]

Citing the 15-Country Collaborative Study of Cancer Risk among Radiation Workers in the Nuclear Industry, Mezrich challenges purported associations between low-dose radiation exposure and harm. The study investigators analyzed the risk of death among 407,391 nuclear workers, and, in fact, found a significant association between the radiation dose and both all-cause and all-cancer mortality.[4] The observed rates of death exceeded expected rates even at cumulative doses as low as 5 to 50 mSv. The authors of the study concluded that their data were consistent with the conclusions of Biological Effects of Ionizing Radiation (BEIR) VII, which showed "a linear, no-threshold dose–response relationship between exposure to ionizing radiation and the development of cancer in humans."[4]

I wholeheartedly agree with Mezrich that "we harm our patients and ourselves by making assumptions . . . not adequately supported by data." That is why it is essential to perform large-scale, randomized trials that will provide the data we and our patients need to make informed decisions. For example, the 50,000-patient National Lung Screening Trial (ClinicalTrials.gov number, NCT00047385) was designed to determine whether CT scanning reduces the rate of death from lung cancer among smokers.

Budhraja and Diamond suggest that most, if not all, overuse of imaging tests can be attributed to defensive medicine. Defensive practices may account for a small, but real, proportion of overuse.[5] However, other factors also are at play, including the practice culture, fee-for-service incentives, aggressive marketing, patient perceptions that overestimate the capabilities of modern technology, direct-to-consumer marketing, and third-party payments shielded from patient view.[5] Large-scale definitive trials may well help to align defensive with evidence-based medicine.

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Uterine Fibroid Embolization

TO THE EDITOR: In their article on uterine fibroid embolization (Aug. 13 issue),[1] Goodwin and Spies highlight few contraindications to the procedure; among them are "pregnancy, suspected cancer, active infection, or indeterminate endometrial or adnexal abnormalities." They also cite the U.K. Hysterectomy or Percutaneous Embolisation for Uterine Leiomyomata (HOPEFUL) study, which showed a 2.6% incidence of septicemia after uterine fibroid embolization, with 1.1% of the women requiring emergency hysterectomy.[2]

Severe infection, often necessitating urgent

hysterectomy, is a rare but well-established complication of uterine fibroid embolization.[3] The FIBROID registry (Fibroid Registry for Outcomes Data) of 3160 patients showed an emergency hysterectomy rate of only 0.09% at 30 days.[4] Emergency hysterectomy for bleeding has been described 4 months after uterine fibroid embolization.[5]

Clearly there are thousands of women for whom uterine fibroid embolization has obviated the need for hysterectomy. However, given that this is considered to be a "uterus-conserving" therapeutic approach, the small but appreciable risk of emergency hysterectomy inherent in performing uterine fibroid embolization may not be acceptable to all patients. As such, contraindications to this procedure must include women who refuse a hysterectomy under any circumstances.

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TO THE EDITOR: Serious infectious complications[1-5] may occur more frequently after embolization of large fibroids and are probably not preventable with a short course of antibiotics, since the process of fibroid necrosis and elimination is ongoing for weeks. We report a case of endomyometritis and septic shock 14 days after uterine artery embolization, despite a 3-day prophylactic course of levofloxacin, in a 51-year-old patient with asymptomatic human immunodeficiency virus infection. Indications for the procedure were menometrorrhagia, with resulting iron-deficiency anemia, and pelvic pain; magnetic resonance imaging (MRI) had shown 17 submucosal and intramural uterine fibroids, the largest of which was 6.1 cm in diameter. After the procedure, the patient had

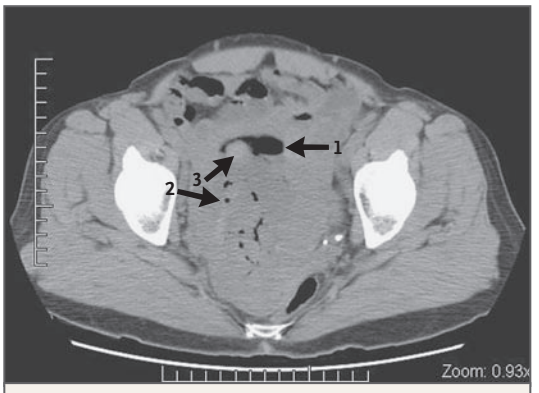

Figure 1. Computed Tomographic Scan of the Abdomen and Pelvis without Contrast, Showing an Enlarged and Distended Uterus.

Gas and fluid can be seen within the endometrial cavity, with an air–fluid level (arrow 1). The gas (arrow 2) may be present within the blood vessels of the uterus or uterine fibroid or trapped within a necrotic fibroid or endometrial clot. At the level of the air–fluid juncture, there appears to be a dense fibroid, blood clot, or pus ball (arrow 3). Fibroid transcervical expulsion probably confers a predisposition to infection, and unsuccessful expulsion of a necrotic fibroid probably enhances that risk.

persistent abdominal cramps and vaginal discharge of black, foul-smelling tissue. Fourteen days after the procedure, rigors and worsening abdominal cramps developed, and she presented with septic shock, with a hematocrit of 21% (baseline, 34%). The abdomen was tender over the uterus, and there was a vaginal discharge of dark blood. An abdominal computed tomographic (CT) scan was abnormal (Fig. 1). Blood cultures grew *Streptococcus bovis* and *Prevotella melaninogenica;* a cervical culture grew *S. bovis.* The patient was successfully treated with a 14-day course of antibiotics.

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THE AUTHORS REPLY: We appreciate the comments of Walsh. We agree that a very small number of patients will require hysterectomy after uterine fibroid embolization because of complications. However, contraindicating uterine fibroid embolization in patients who desire a uterus-sparing option may leave some patients with no reasonable option once medical therapy has been exhausted. Myomectomy may rarely lead to hysterectomy, and the risk of conversion may be higher than it is with uterine fibroid embolization, thus excluding myomectomy as an option for these patients. Similarly, endometrial ablation[1] and focused ultrasonography have more limited applicability[2]; in addition, both of these interventions also are likely to confer a small but real risk of hysterectomy due to a complication. The best approach is an informed-consent process in connection with any of these interventions that includes a discussion with the patient of the risks, including the risk of hysterectomy. With this knowledge, most patients can weigh the relative risks of their options and make an informed choice.

We also thank Halpern et al. for presenting their case. As they point out, some reports have correlated the size of fibroids with an increased risk of poor outcomes after uterine fibroid embolization. Another possible predictor of infection is location. Since presumably infection of a fibroid can result only from bacterial seeding from the endometrial cavity, the location of a fibroid has often been considered to be a more likely prognosticator of infection than has size. However, in a study involving a large series of patients, in which the effect of the size and location of fibroids on the rate of infection was specifically examined, no correlation with either size or location was found.[3] The lack of consistency in the literature suggests that more research is needed. CT findings after uterine fibroid embolization can be misleading, since findings such as gas can occur in patients who do not have an infection.[4] In general, MRI is viewed as a more powerful tool for evaluating patients after uterine fibroid embolization.[5] We agree that a long course of antibiotics may be necessary. This case highlights the importance of surveillance of patients — and particularly immunocompromised patients — after any therapy. A similar level of increased risk might be anticipated with any intervention in an immunocompromised patient.

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Case 27-2009: A Woman with Fever, Rash, and Lymphadenopathy

TO THE EDITOR: In Case 27-2009 (Aug. 27 issue),[1] the patient's clearly stated initial symptom, a week-long systemic reaction that began 4 hours after a fire-ant sting and resolved in response to prednisone, was not discussed in the context of the final diagnosis, angioimmunoblastic T-cell lymphoma. The patient's reaction is similar to the marked delayed-hypersensitivity reactions long known to occur after mosquito bites in persons with chronic lymphocytic leukemia.[2] Such reactions may be the presenting symptom of this condition. Other states of immune dysregulation,[3] including lymphomas,[4,5] have also been linked to such reactions.

Although mosquitoes and fire ants are in different orders (Diptera and Hymenoptera, respec-