

Male Sexual Impotence: A Case Study in Evaluation and Treatment

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DR. JOHN HALVORSEN (*Assistant Professor, Department of Family Practice and Community Health*): Male sexual impotence is the inability to obtain and sustain an erection adequate to permit satisfactory penetration and completion of sexual intercourse. Impotence is defined as *primary* if erections have never occurred, and *secondary* if they have previously occurred but subsequently have ceased. The cause of sexual impotence may be psychogenic, organic, or mixed. In the past, the common belief was that 90 percent of impotence was psychological.^{1,2} Recent research indicates, however, that over one half of men with impotence suffer from an organic disorder, although often there is considerable overlap between both psychological and organic causes.^{3,4}

A knowledge of the anatomy of the penis and the complex physiology of erection is necessary to understand the cause of the problem, the methods of diagnosis, and the treatment options.

ANATOMY AND PHYSIOLOGY

The three major parts of the penis are (1) the base, which is anchored to the perineum; (2) the body, composed of the paired corpora cavernosa located dorsally, and the corpus spongiosum, located ventrally; and (3) the terminal portion, the glans, an enlargement of the tip of the corpus spongiosum. The corpora cavernosa are separated by an incomplete connective tissue septum that permits free communication of blood between the corpora and that allows them to function as a central unit. They are also fused in the body and proximally diverge to attach to the inferior aspect of the pubic rami. The corpus spongiosum houses the urethra and lies ventral between the corpora

cavernosa. There is also a very important suspensory ligament—a triangular structure attached at the base of the penis and to the pubic arch blending with Buck's fascia around the penis—that is responsible for forming the angle of the erect penis.

The arterial supply to the penis flows from the aorta through the common iliac, hypogastric, and internal pudendal systems. The artery of the penis is a branch of the internal pudendal artery and has four branches. The first branch, the artery to the bulb, supplies the corpus spongiosum, the glans, and the bulb. The second branch is the urethral artery. The artery of the penis then terminates into the dorsal artery of the penis (which supplies the deep fascia, the penile skin, and the frenulum) and the deep or profunda branch (which supplies the corpora cavernosa on each side).

The venous drainage consists of both a superficial and a deep venous system. The superficial dorsal vein drains into the external pudendal vein, which then connects to the saphenous system. The corpora cavernosa and the corpus spongiosum flow into the deep dorsal vein, which drains into a plexus of veins called the lateral prostatic vesical venous plexus, or Santorini's plexus.

The penis has somatic, sympathetic, and parasympathetic innervation. These fibers originate from two areas—spinal segments T-12 through L-2 and segments S-2 through S-4. The afferent somatic fibers responsible for penile sensation travel through the dorsal nerve of the penis to the internal pudendal nerve back to its spinal roots S-2 through S-4. These fibers supply the ischiocavernosus muscle, the bulbocavernosus muscle, penile skin, and urogenital diaphragm. The parasympathetic fibers, on the other hand, originate from the anterior roots of S-2, S-3, and S-4, and are known as the nervi erigentes. They terminate in the small and large cavernous nerves supplying the penis. The sympathetic fibers originate from the spinal roots of T-12 through L-2, descending through the aortic plexus, the superior hypogastric plexus, the inferior hypogastric nerves, and finally intermingling with the parasympathetic nerves as they reach the penis itself.

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Physiologically, erection involves a neurologically mediated series of events that subsequently give rise to complex vascular events that result in increased size and rigidity of the penis. The single, most basic factor producing an erection is that more blood must enter than leave the cavernous spaces.

Psychogenic erections are cortically mediated by sight, sound, smell, and thought. The exact neurotransmitter mechanisms involved are poorly defined, but it is believed that both dopamine and serotonin are important. Testosterone is also needed for libido and ejaculation. Cortical stimuli exit first through the preoptic region of the hypothalamus, then through the pons and cord, exiting through T-12 and L-2. Reflex erections occur by way of the sacral reflex. The afferent limb arises from somatic fibers S-2 through S-4 by way of the pudendal nerve as previously mentioned, and the efferent limb (the parasympathetic limb) exits through the nervi erigentes from S-2 to S-4. There is complex mingling of sympathetic and parasympathetic fibers so that in the neurologically intact individual both psychogenic and reflex pathways act synergistically for erection to occur. The exact biochemical mechanisms that enable these neurologic signals to increase blood flow to the corpora are yet to be completely defined, although adrenergic transmitters seem to be more important than cholinergic. Vasoactive intestinal peptides may also play an important role.

After this basic science review, Dr. Craig Mommsen, the family practice resident who coordinated the patient's evaluation, will present the history and examination obtained on the first visit to our clinic.

CASE PRESENTATION

DR. CRAIG MOMMSEN (*Third-year Resident in Family Practice, University of Minnesota, University Family Practice Unit*): Mr. J., a 56-year-old gentleman whose chief complaint was the inability to obtain erections after having slipped and fallen, appeared at the University of Minnesota Family Practice Clinic three years after his fall. He had slipped on the ice, fractured his left patella, and driven his left foot into his perineum. Since that fall he had not had any erections, but he had been able to ejaculate with manual stimulation. He had had a partial evaluation at another clinic prior to visiting the University Family Practice Clinic. This evaluation indicated a low, or borderline low, testosterone level, and he was given a trial on oral testosterone in an attempt to improve his sexual function. He was also evaluated by a psychologist, who thought he did not have a significant psychological cause for his impotence. Despite these measures, his impotence had persisted and had continued to concern him and his wife.

Additional history obtained during his initial visit to our clinic indicated that he was sexually competent and had achieved orgasm with a normal erection a day before his injury. His previous workup had included a "stamp test," which is a crude snap gauge test to measure nocturnal penile tumescence. This test showed no evidence of tumescence.

On initial physical examination Mr. J. was moderately anxious. His blood pressure was slightly elevated at 160/90 mmHg. His heart rate was 72 beats per minute and his weight 204 pounds. His genitourinary examination was normal. Neurologically he had an absent bulbocavernous reflex and decreased proprioception in his left great toe. Vascular examination revealed absent dorsalis pedis pulses bilaterally and absent penile pulses even with the vascular doptone. No penile blood pressure was detectable.

His medical history included multiple problems. Medications included oral testosterone, as previously noted, as well as a β -blocker used to treat his hypertension, which had been only moderately well controlled. He had also been treated for alcohol abuse in 1970 at the Veterans Administration hospital. Chart notes by the psychologist at the clinic where he was initially evaluated indicated that he might again be chemically dependent, but he had refused treatment. He had also sustained a back injury at work in 1975 and had undergone a subsequent laminectomy at the L-4-L-5 level. He had had chronic back pain and a stiff knee since that time. Both of these factors precipitated his early retirement from his machine shop occupation. He also had been a tobacco user at greater than one pack per day for over 20 years. He indicated that he had experienced some anxiety and possibly a slight element of depression; however, these problems had not been treated. The only other additional information obtained during his initial visit to the clinic was a random blood glucose of 105 mg/dL, which was within normal limits.

After the initial visit with him, the problem list, shown in Table 1, suggested multiple possible causes for his impotence. These involved psychologic factors, neurogenic and vascular factors, and the possibility of medication side effects. The patient, therefore, had further evaluation from a neurological, psychological, and vascular perspective. Dr. Michael Metz, from the Program in Human Sexuality at the University of Minnesota, will first address the psychological causes for impotence.

PSYCHOLOGICAL EVALUATION

DR. MICHAEL METZ (*Assistant Professor, Department of Family Practice and Community Health*): At this time, I will discuss the psychological variables that must be considered in evaluating a patient with impotence. We will discuss psychological treatment options later.

TABLE 1. INITIAL PROBLEM LIST FOR MR. J.

1. Impotence following perineal trauma
2. Mild to moderate anxiety and depression
3. Mild hypertension
4. Treatment with β -blocker
5. Tobacco abuse
6. Absent bulbocavernosus reflex
7. Absent dorsalis pedis pulses
8. Absent penile pulses with no detectable penile blood pressure
9. Borderline low testosterone level
10. Failed treatment with oral testosterone
11. History of alcohol abuse, possibly concurrent
12. Previous back injury with subsequent L-4-L-5 laminectomy
13. Persistent chronic low back pain
14. Early retirement secondary to back disability

The psychological evaluation is complicated because the psychogenic and organic causes of impotence normally overlap considerably. Psychological stress can impair sexual performance, but it can also be the result of sexual dysfunction, which often makes a clinical judgment difficult. For this reason, it is essential that a thorough medical workup be completed, as was done in the case we are reviewing. The critical factor from a psychological viewpoint is separating the psychological aspects contributing to the cause of the impotence from the psychological impact of the dysfunction itself.

The psychological evaluation includes psychopathological, psychosocial, and psychosexual factors. The patient is first assessed for psychopathology. The major differential diagnoses in men with impotence are depression and anxiety—the two major psychogenic causes of erectile dysfunction.

Psychologists also look beyond the individual psychological issues to the possible role of the patient's lifestyle. The psychosocial assessment includes a history of the individual, the couple, the family, the career, and the social network. The relational factors—especially the marital relationship—are too frequently minimized in sexual dysfunction assessment and require careful attention. Almost without exception, it is important to evaluate the partner as well as the patient because, from a systems perspective, the identified patient may be the "symptom bearer" for a dysfunctional partner, family, or larger system.

The psychosexual history explores sexual concerns, family sexual issues, sexual trauma, sexual knowledge, past sexual behaviors, sexual fantasy, and sexual expectations.

In addition to the history, results from psychological tests can shed light on such issues as depression, anxiety,

obsessiveness, marital distress, and other potential factors that may contribute to impotence. The Minnesota Multiphasic Personality Inventory (MMPI),⁵ Tennessee Self-Concept Scale,⁶ Beck Depression Inventory (BDI),⁷ and Brief Symptom Inventory (BSI)⁸ are useful tools in assessing individual psychopathology. Relational factors can be assessed by such instruments as the Locke-Wallace Marital Adjustment Test,⁹ the Dyadic Adjustment Scale,¹⁰ Marital Satisfaction Inventory,¹¹ and the Family APGAR.¹² These brief, easily scored measures can give a concise reading of whether relationship factors may be implicated in the sexual dysfunction. Psychosexual aspects are evaluated by such instruments as the Sexual Interaction Inventory (SII),¹³ Sexual Behaviors Inventory (SBI),¹⁴ and the Sexual Adjustment Inventory (SAI).¹⁵

Several psychological influences may contribute to Mr. J.'s impotence. One is depression. Evaluation indicated some signs of depression, which were likely related to his involuntary retirement as the result of his back injury and loss of function, as well as chronic pain. The patient's suspected chemical misuse supports the presence of depression and provides as well a possible direct barrier to erections through the action of ethanol on the central nervous system.^{16,17}

Another factor may be anxiety or fear. He seemed fearful of the back surgery he underwent four years earlier, and he also exhibited a moderate fear of dying (which his wife felt was a significant issue for him). Each of these factors could undermine his individual confidence, an important factor in healthy sexual functioning.

From an interpersonal perspective, he experienced apparent marital or intimacy dysfunction, control or conflict problems with his wife, and changes in their relationship patterns stemming from his retirement. His wife experienced the death of four relatives during the year before the onset of the patient's impotency. Although his wife's bereavement may seem remote from the patient's situation, such events can contribute to dysfunction through a psychological phenomenon known as the *chaining effect* in which a sympathetic allegiance or alliance develops in the partners. This chaining effect could have caused Mr. J. to become anxious and depressed with secondary erectile dysfunction.

Family issues surrounding their children, apprehensions about aging, and negative sexual attitudes may also have added stress and complicated the patient's impotency.

While these and other psychological factors are capable of causing erectile dysfunction, Mr. J.'s case is an excellent example of the primacy of a thorough medical workup and of the importance of presuming an organic cause unless it is ruled out.

DR. MOMMSEN: After Mr. J.'s initial clinic visit, additional laboratory data were obtained. These included normal VDRL, leutenizing hormone, prolactin, testos-

terone, and follicle-stimulating hormone levels. There was also concern that Mr. J. might be diabetic, and a three-hour glucose tolerance test was performed. This test indicated impaired glucose tolerance but not frank diabetes. A nocturnal penile tumescence study was also performed that showed he experienced no nocturnal erections. Normally he should have obtained four to six erections per night.

Because of the abnormal findings in his neurologic examination, the patient was referred for neurologic consultation to Dr. James Moriarty, who will discuss his examination of Mr. J. and the neurologist's approach to the problem of impotence.

NEUROLOGIC EVALUATION

DR. JAMES MORIARTY (*Assistant Professor, University of Minnesota Department of Neurology*): Mr. J.'s comprehensive neurological examination indicated several problems. He walked slowly, favoring his left leg, and he was unable to walk on his heels and toes and unable to hop on either foot. There was a variable guarding response when the muscles in his left lower extremity were examined. The reflexes were also decreased in that extremity, and there was slight atrophy of the left gastrocnemius muscle, all of which probably related to his previous back problems. He had slight incoordination on his finger-to-nose testing, hypalgesia of his left foot, and proprioceptive loss of his left great toe. A complete back examination revealed marked diffuse tenderness, which was not localized in any particular area. He had a normal anal reflex with good sphincter tone, the cremasteric response was present bilaterally, the abdominal reflexes were present in all quadrants, and the bulbocavernous reflex was diminished to absent.

The bulbocavernous reflex is an important reflex to test in patients with impotence, since it evaluates the cord segments S-2 through S-4. It is tested by stimulating the dorsal glans penis by pricking or pinching and then feeling for contraction of the bulbocavernous muscle. This muscle can be palpated when the fingers are placed behind the scrotum in the perineal region.

At the completion of the neurologic evaluation, discontinuing the β -blockers was advised and an evaluation of thyroid function (which turned out to be in the low normal range) was recommended. The Electromyograph Laboratory was not at the time doing any latency tests of the bulbocavernous reflex or penile-evoked potentials to compare latency with the perineal-evoked potentials. These tests might have been helpful in identifying whether some of the erectile dysfunction was due to inadequate innervation.

The nerve physiology of erection, as has been discussed by Dr. Halvorsen, is complex and involves interplay between the sacral region, the lumbar region, and the central nervous system. Normally they all work together. One can have an erection, however, with a reflex from just the sacral region or from the thoracic region alone. Bors and Comarr,¹⁸ who have studied spinal cord lesions of various degrees, found that even after disruption of the cord, 86 percent of patients had the ability to have an erection; however, only 19 percent could have ejaculations, and only 14 percent could have orgasms.

In assessing Mr. J.'s impotence from a neurological perspective, several important observations can be made. He did not have a cauda equina lesion. If so, he would have had bowel and bladder as well as sexual dysfunction. In his fall, his foot injured the genitourinary diaphragm area, which is very susceptible to injury. The nerves involved in this type of injury include three terminal branches of the pudendal nerve. The first of those nerves, the inferior hemorrhoidal nerve, retained its normal function in Mr. J. because the external sphincter and the anus functioned normally, the anal reflex was present, and there was no sensory loss.

The second terminal branch of the pudendal is the perineal nerve, which supplies the spongiosum—both the bulb and the corpus. It also supplies the scrotum, the perineal muscles, the skin, the perineum, and the mucous membrane of the urethra. The status of the sensation within Mr. J.'s urethra was not assessed during examination, but he did have ejaculatory ability after this accident. He did not, however, have any function of the dorsal nerve of the penis, which supplies the crus, the corpora cavernosa of the penis, and the skin of the distal two thirds of the penis.

In summary, from a neurologic perspective it appears that Mr. J. had several possible reasons for his impotence, which included his tendency toward diabetes and his history of perineal trauma. To complete this discussion, it is important to know that the major neurological causes for organic impotence include neuropathies, diabetes (the most common of all organic causes), spinal cord injuries, cerebrovascular accidents, temporal lobe epilepsy, parkinsonism, and multiple sclerosis.

DR. MOMMSEN: Mr. J. also had abnormal findings on his penile vascular examination. Dr. David Hunter from the Department of Radiology evaluated these findings and will discuss the appropriate radiologic evaluation of impotent men.

RADIOLOGIC EVALUATION

DR. DAVID HUNTER (*Assistant Professor, University of Minnesota Department of Radiology*): The three vas-

TABLE 2. TREATMENT OPTIONS FOR IMPOTENCE

Traditional treatment methods

- Psychological causes
 - Psychotherapy
 - Counseling
 - Penile prosthesis

Organic causes

- Penile prosthesis
- Hormone replacement

Modern treatment methods

- Penile revascularization
- Penile venous surgery
- Intracavernous drug injections

ular-imaging modalities available at the University of Minnesota to evaluate impotence include noninvasive vascular imaging with Doppler or duplex ultrasound, angiography, and corpora cavernosography. Duplex ultrasound is the most common test we perform, since it is noninvasive and is accurate as a screening tool.¹⁹ Angiography²⁰ is the primary study done on men who are suspected of having impotence on an arterial basis. It permits an accurate evaluation of arterial adequacy and helps to plan for surgical vascular reconstruction or angioplasty, which can be very successful in selected cases of large-vessel arterial disease. Arteriography is performed by cannulating the anterior division of the internal iliac artery and identifying the internal pudendal artery. With the catheter selectively positioned in the anterior division, papaverine is then injected directly into the corpora cavernosa with a 25-gauge needle. Papaverine allows maximum vasodilatation to occur and permits visualization of all small vessels that are present.

In Mr. J., the left internal iliac artery was injected first. It was found that the pudendal artery, where it bifurcates to give rise to the penile and bulbar arteries, was totally obstructed. There were a number of collateral vessels originating from an unnamed branch of the pudendal artery that bypassed the obstruction, reconstituting the penile artery. The penile artery beyond the artery to the bulb was severely diseased and irregular. There was also an area of obstruction in one of the branches of the artery to the bulb, with a small collateral vessel bypassing it.

On the right side, the disease was even more severe. The terminal branches of the pudendal artery basically ended in a small collateral vessel to the bulb, with no continuation past that point into the artery of the penis. A small collateral artery arose from the artery to the bulb and extended toward the deep artery of the penis, but it never established continuity. There was no opacification of the vessels on the right.

In summary, an arteriographic examination of Mr. J. showed severe bilateral disease that was more than ade-

quate to explain any erectile dysfunction. The disease was located in the region of the perineum where his trauma occurred and also proximal to that point. The disease may have had, therefore, a significant arteriosclerotic component to it as well.

DR. MOMMSEN: Dr. Paul Lange from the Department of Urology will next comment, with particular reference to the possibility of surgically bypassing Mr. J.'s vascular lesions. He will also comment on other current and investigational forms of therapy.

UROLOGIC EVALUATION AND TREATMENT

DR. PAUL LANGE (*Professor of Urology, University of Minnesota Department of Urology*): Historically the methods of evaluating and treating impotence have been relatively simple, as Table 2 shows. A few tests were performed, a guess was made as to cause, and one or both of two treatments were applied: penile prosthesis or psychotherapy or a combination of the two. Hormonal treatment was also important, but how important depended on the specialist one consulted. Endocrinologists indicated a hormonal cause in many patients.^{21,22} However, our experiences as urologists, who saw most of these impotent patients and obtained all the hormonal studies, was that very few impotent patients were found who had a hormonal cause. A fair number of patients had some aberration in their hormonal studies, but usually these aberrations were secondary to other diseases.²¹ When these patients were given testosterone, they often responded for a couple of months, especially the ones who had a psychogenic component to their disease, but that response was only temporary.

All impotence problems have a psychogenic component; all impotent patients are psychologically affected. The question is, which comes first? At one time, as Dr. Halvorsen mentioned earlier, it was thought that impotence was 90 percent psychogenic,^{1,2} but now there is growing consensus that the causes of the problem are at least 50 to 75 percent organic in most patients.^{3,4} Psychogenic evaluations are still important because they help with the differential diagnosis. Their greatest value, however, is in providing an indication of other factors affecting the patient, such things as drug dependency, marital problems, depression, and work stress. Psychological evaluation and support are also important elements in bringing patients back to functional sexual activity. A stiff penis by itself does not necessarily make a man sexually functional.

The diagnostic evaluation of sexual impotence has become both more complex and more simple. It is more simple in the sense that the physician does not have to juggle Freudian terminology and discuss involved psy-

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TABLE 3. UNIVERSITY OF MINNESOTA IMPOTENCE CLINIC EVALUATION

- Sexual and medical history
- Hormone levels
 - Leutenizing hormone
 - Follicle-stimulating hormone
 - Prolactin
 - Testosterone
 - Fasting blood sugar
- Neurologic evaluation
 - Penile blood pressures
 - Arteriography
 - Infusion—outflow studies
 - Papaverine stimulation
- Nocturnal penile tumescence studies
 - Snap gauge
 - Sleep studies
- Urologic system evaluation
- Psychological evaluation

TABLE 4. RELATIVE INDICATIONS FOR PELVIC ARTERIOGRAPHY IN IMPOTENCE EVALUATION

- Abnormal nocturnal penile tumescence study
- Abnormal penile brachial index
- Absence of a neurohumoral disorder
- Candidate for revascularization
 - Age < 60 years
 - No diabetes
 - No hypertension

choanalytic mechanisms as much. Other approaches to the evaluation have become more complicated. Table 3 displays the basic evaluation that urologists at the University of Minnesota use when evaluating impotent patients.

The history, physical examination, and routine evaluation usually provide an accurate sense of the cause of impotence. Urologists also often use a special diagnostic procedure, the Nocturnal Penile Tumescence Study (NPT), to determine whether the patient has nocturnal erections.⁴ If he has none, the patient has an organic problem. If his problem were psychogenic, he would have erections at night but he would not be able to obtain them when his supratentorial mechanisms are operational. The NPT test is not infallible. These tests, for example, are conducted in highly artificial environments. A man in a hotel room who has taken two sleeping pills and who has then been placed on a monitor may not obtain erections when under more normal circumstances he would. In addition, some patients experience tumescence but not rigidity. Many patients show a positive NPT but do not obtain erections that are sufficient for penetration, or if they do penetrate, they quickly lose the erection. Newly developed machines are solving this problem, since they are capable of measuring both rigidity and tumescence.

The vascular examination has changed much of our evaluation. Doppler flow studies have improved diagnostic ability considerably, but the conduct of one of these studies can pose problems. One needs to measure the deep dorsal arteries of the penis, not the superficial artery, or the artery to the bulb or the glans, a measurement that can be difficult to perform. In addition, although measurement of penile blood pressure is the best screening test for a general clinic, blood pressure alone does not equate with flow.

More use is being made of ultrasound, therefore, which measures the width of the arteries—with and without a papaverine injection into the corpus cavernosum—to provide a better indication of actual flow.

Patients who are being evaluated in the Impotence Clinic at the University of Minnesota are first provided with enough patient education to allow them to answer questions accurately. Some patients may answer questions inappropriately because they are afraid to admit that they do not know what the terms *ejaculation* or *orgasm* mean. After this initial orientation, patients go through a series of tests, including the Doppler flow study and the ultrasonic evaluation with papaverine injection. No one test is used alone in making a diagnosis. Patients who have true vascular causes for their problem, however, usually have low Doppler flow scores. A penile brachial index (PBI) has been devised to compare penile systolic with brachial systolic pressure. The index, which has been helpful in evaluating patients whose impotence is vasculogenic, is the result of dividing the penile systolic blood pressure value by the brachial systolic blood pressure value. A normal PBI would be greater than 0.75; a low PBI would be less than 0.60.

Sometimes arteriograms are necessary, but their interpretation is difficult. It is difficult to determine in a 60-year-old patient exactly which abnormalities on the arteriogram significantly contribute to the cause of his problem because we do not know what a normal arteriogram looks like in a similar potent patient who may have some arteriosclerosis. Arteriography is also invasive and has significant side effects. Table 4 shows the relative indications we have developed for pelvic arteriography. Arteriography is used mainly for evaluating patients who are candidates for arterial surgery, and it should not otherwise be performed unless it is part of an experimental protocol.

MANAGEMENT

A number of different procedures have been devised for vascular reconstruction. The ideal case is a young patient

with a pelvic fracture who has a block in the penile artery at the area of the pubic bone and who has good distal runoff. The epigastric artery can then be anastomosed in such a way that revascularization can occur with retrograde flow. This type of case is uncommon; but with these patients there is a 60 to 70 percent success rate in the ability to penetrate.

For patients who have definite vasculogenic impotence related to diffuse arterial disease, such as occurs in diabetes and generalized arteriosclerosis, the inferior epigastric artery may be anastomosed to the dorsal vein, which is then anastomosed to the corpora cavernosa. This procedure sends blood into the corpora cavernosa so that erections occur, and provides for sufficient runoff so that priapism is avoided. Many surgeons claim that this procedure does result in major functional improvement among selected patients. Bennet et al²³ recently reported on five such cases. Enthusiasm must be tempered with careful evaluation, however, since most psychogenic impotence also responds to this operation.

Venous ligation is also an appropriate surgical procedure in some patients when the balance between inflow and outflow is such that, because of the venous anatomy, the rate of outflow exceeds the decreased inflow to the point that the patient cannot sustain an erection. Papaverine infusion studies are helping to determine whether the patient's vascular problem is related to insufficient inflow or excessive outflow or to a combination of both.

Eight different varieties of penile prostheses are also now available for the management of impotence. Most prosthetic devices are inserted under local anesthesia and perform very well. Approximately 90 percent of carefully selected patients who use these prostheses are satisfied with the result.²⁴

In addition to these methods of treatment, self-injection of intracavernous vasoactive drugs is being carefully examined.²⁵⁻²⁷ The Impotence Clinic at the University of Minnesota has now acquired experience with over 300 patients who have chosen this method. This technique involves injecting a drug—an α -adrenergic blocker (phentolamine) or an alkaloid such as papaverine—into the corpus cavernosum. This action causes vasodilatation and relaxation of the muscles of the corpus cavernosum, which results in decreased arteriolar resistance and, by secondary passive means, increased resistance of the veins, all of which results in erection.

Although this procedure requires a great deal of patient education, it has been very well accepted by our patients. Priapism is a potential problem, and if it occurs, it must be treated promptly, usually by infusion of a vasoconstrictor. A more important potential problem is the development of long-term fibrosis in the penis seen in patients who have used this technique for some time. Penile prostheses have been placed in patients with fibrosis. Al-

though insertion of a prosthesis in a patient with fibrosis is more difficult, it still is clinically possible and provides good functional results.

Injection seems to work very well. The long-term side effects do not seem serious, but candidates for injections must be selected carefully and followed closely. For example, patients with a spinal cord injury or patients who have pure neurogenic impotence are highly sensitive to these vasoactive drugs. A patient who is not monitored closely can develop priapism very easily. Sexual stimulation can also potentiate the action of these drugs in many people; the dose required in the clinic to produce an erection may be far more than ordinarily required. In our clinic experience thus far, if a patient has pure neurogenic impotence, injections work 100 percent of the time. In other cases in which both vasculogenic and neurogenic causes exist, injections are working over 80 percent of the time. In patients who have a purely vasculogenic impotence, injections are working approximately 40 percent to 50 percent of the time.

The cause of Mr. J.'s impotence appeared primarily vasculogenic, although it certainly could have a neurogenic component. In evaluating him further, I would certainly use papaverine injection as a diagnostic test. Although I would not use the patient's response as the only indicator for dictating therapy, it certainly would help. If he did respond with an erection from injection, and the doses required were not too high, I would suggest continuing this management approach. If he did not respond, I would probably suggest penile prosthesis surgery. Considering that the success rate with the vascular operation is only about 40 percent, if the vascular operation did not work, we would have to suggest a penile prosthesis anyway—a treatment that is 100 percent successful with a 95 percent satisfaction rate. Usually, when patients are given the option between one operation or two, few say, "Let's try the vascular operation first, and if this doesn't work, then we'll go ahead with the second surgery."

DR. METZ: I want to complete our discussion of impotence by mentioning some psychological aspects of treatment. In addition to medical or surgical treatment, it is important to consider primary care psychological counseling. Psychological treatment can be approached from several directions. Even when there is a reversible organic cause, we prefer to treat psychologically to counter any detrimental effects of the dysfunction. The goal of therapy is to increase sexual satisfaction. This usually means adjusting the sexual interaction so that an erection is not expected and the couple does not rely on intercourse exclusively for sexual pleasure. With this approach, there is greater sexual enjoyment and often an improvement in technical performance, even in erections. In Mr. J.'s case, in cases of irreversible organic cause, or whenever the patient declines medical options, psychological therapy

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may be more appropriately approached as rehabilitative therapy to help the person and his wife adjust to the organic changes or the loss of erection.

Treatment of the couple starts with a series of behavioral exercises that they do together at home. They then return to discuss with the therapist or with a therapy group their experience. Another series of exercises is then assigned. These exercises teach relaxation, because psychologically one of the major causes of sexual difficulty is pressure and stress, or performance anxiety, to use Masters and Johnson's terminology. Psychological treatment also deals with cognitions because men who begin to have erectile problems begin to develop a whole set of negative cognitive scripts. One script that the psychologist who initially saw this patient identified was "I'm not going to start something I can't complete." Consequently, Mr. J. began to avoid his partner. The intimacy, the touching, the closeness began to suffer; and his wife began to feel unloved, undesired, and unwanted. That cognitive script change precipitated a whole series of detrimental events in their relationship.

In this particular case marital therapy would also be helpful. The stress on the relationship because of the impotency is clear, but peripheral issues, such as his retirement, deaths in the family, chemical misuse, and problems with the children, could also benefit from psychological treatment.

Other psychological treatment possibilities are mainly designed to help with relaxation and reteaching. Reteaching involves learning nongenitally focused pleasure and learning to have intercourse without erection. One method is to have the female partner insert the nonerect penis into her vagina and then have each partner stimulate one another manually and by body movement without technical erection, resulting in pleasure and even orgasm in some cases. When organic damage is irreversible, we emphasize that there are options for sexual pleasure if not for organic performance. The main goal of treatment is increasing pleasure and intimacy rather than increasing performance.

SUMMARY

DR. HALVORSEN: In summarizing today's Grand Rounds, there are at least six messages I think need to be emphasized.

1. The basic sciences do have an application to clinical medicine. I hope that reviewing the anatomy of the penis and the physiology of erection has helped you understand more completely the cause of the problem, the rationale underlying the diagnostic methods, and how treatment works.

2. The problem of impotence is complex. It does not break down easily into one category or the other. Although Mr. J.'s arterial disease was extensive enough to account for his problem by itself, we are still left wondering about the extent to which his neurologic abnormalities, tobacco abuse, potential alcohol abuse, anxiety and depression, chronic pain, and relationship problems contributed to the cause of his disorder.

3. More treatment options are becoming available as etiologic understanding becomes more clear.

4. Treatment for impotence, regardless of cause, is very successful and should encourage us to search for this problem in our patients more aggressively.

5. Organic and psychological evaluation and treatment should be carried out simultaneously. Even in purely organic impotence, the psychological influences of the problem on the man and on the marital relationship need to be explored and in many cases treated.

6. The family physician can play a very active role in both evaluating and managing impotence. He or she can obtain a comprehensive medical and psychosocial history of the patient and the family, perform a complete physical examination, and obtain the necessary laboratory testing in consultation with a radiologist or a urologist. Many psychogenic problems are well managed by the family physician alone or by coordination with a sexual counselor. Referral to a urologist is appropriate for men who desire penile injection of vasoactive drugs, penile prosthesis, or for vascular surgery.

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