

further study of the potential risk of immune related connective tissue disorders in humans with these implants is warranted.

9. Biological Effects of Silica

Amorphous (fumed) silica is bound to the silicone in the elastomer of the implanted mechanical/hydraulic urinary continence device, and may be fibrogenic and immunogenic. Fumed silica and the silicone elastomer each elicit cellular responses in rats (Ref. 69). Researchers have reported that there is an association between industrial exposure to silica and development of systemic lupus erythematosus (Ref. 41). The biological effects of silica, particularly the immunologic component of these reactions, present a potential risk for device recipients and need to be examined.

10. Silicone Particle Shedding, Silicone Gel Leakage, and Associated Migration

Silicone particle shedding and subsequent migration have been reported with genitourinary prosthetic devices, including implanted mechanical/hydraulic urinary continence devices (Refs. 70 and 71). Silicone gel leakage and migration from the silicone elastomer envelope, either from rupture of the envelope or by leaking of the gel through the envelope (gel "bleed"), are also potential significant risks of implanted mechanical/hydraulic urinary continence devices containing silicone gel. Rupture of the envelope with gel leakage and subsequent migration may be secondary to surgical technique, or may result from mechanical stresses such as device usage, trauma, and wear on the envelope, and necessitates removal of the implant. In addition, silicone gel-filled breast implants are reported to "bleed" micro amounts of silicone through the intact silicone elastomer shell into the surrounding tissues (Refs. 72 through 81). Furthermore, fluorosilicone gels have been used to lubricate the inner surfaces of cuff shells (Ref. 36) and, therefore, are an additional source for gel bleed. Although diffusion of silicone gel through the elastomer envelope and silicone particle shedding have not specifically been measured (e.g., quantified) in the implanted mechanical/hydraulic urinary continence device, they have been reported (Ref. 70) and, therefore, particle shedding and gel bleed continue to be potential risks with this device and need to be evaluated. Migration of the particles and gel into the human body presents the potential for development of adverse effects such

as granulomas, lymphadenopathy, or cellular immune response (Refs. 41, 58, 59, 70, and 71). The ultimate fate of migrating silicone particles or silicone gel within the body is currently not well understood. It should be noted that the use of silicone gel in these devices may have been discontinued.

11. Degradation of Polyurethane Elastomer

Polyurethane elastomer materials, which may be present in some implanted mechanical/hydraulic urinary continence devices, may degrade over time and release degradation products such as methylene diamine or toluene diamine, which are potential carcinogens in animals (Refs. 82 and 83). FDA is not aware of any mechanical/hydraulic urinary continence devices which currently use this material. This potential risk is associated only with those implanted mechanical/hydraulic urinary continence devices that contain polyurethane elastomers.

12. Degradation of Polyurethane Foam

This potential risk is associated only with those implanted mechanical/hydraulic urinary continence devices that are covered with polyurethane foam. The polyurethane foam material that has been used to cover some devices is known to degrade over time with a potential breakdown product of 2,4 diaminotoluene (TDA), a known carcinogen in animals (Refs. 84 through 89). The fate of the degraded product in vivo is unknown to date, and the use of this material in implanted mechanical/hydraulic urinary continence devices may have been discontinued. Case reports of polyurethane foam covered silicone gel-filled breast implants indicate that there is greater difficulty with the removal of this type of prosthesis due to fragmented polyurethane shell and/or capsular tissue ingrowth (Refs. 90 through 96). Also, foreign body response has been reported concurrent with the use of the polyurethane foam covered testicular prosthesis in humans (Ref. 97).

13. Other Reported Complications

The following are among the additional risks which have also been reported with the implanted mechanical/hydraulic urinary continence device: perineal discomfort/pain (Refs. 10, 17, and 27); development of bladder hyperreflexia (Refs. 98 through 100); worsening/persistence of incontinence (Refs. 51, 99, and 100); urinary retention (Refs. 51 and 101); hematoma (Ref. 28); seroma (Ref. 44); inguinal hernia formation (Ref. 102);

fibrous capsule formation, failure of cuff to deflate, broken tubing (Ref. 51); fistula formation from urethral erosion (Ref. 8); urethral scarring (Ref. 99); bleeding (Ref. 103); urethral stricture requiring urethrotomy (Ref. 101); wound dehiscence, pelvic abscess (Ref. 104); and fistula to the skin (Ref. 10).

F. Benefits of the Device

The implanted mechanical/hydraulic urinary continence device is intended to provide intermittent or continuous pressure to occlude the urethra, thereby restoring urinary continence. The device is indicated in males or females whose urinary sphincter is dysfunctional.

Implants have been used to treat incontinence resulting from prostatectomy, myelopathy (e.g., spina bifida, myelomeningocele), spinal column injury, sacral agenesis/dysgenesis, exstrophy/epispadias syndrome, pelvic trauma, and other conditions.

Although there are adverse physiologic effects associated with urinary incontinence (e.g., infection and skin irritation due to exposure to urine) (Ref. 105), the incontinent patient's mental health and quality of life can also suffer significantly. Incontinence can be socially, psychologically, and physically debilitating (Refs. 43 and 106). A reduction of social activities and interactions can be associated with the loss of urinary continence (Ref. 105). The loss of self-esteem (Ref. 107) and emotional problems (Ref. 25) have also been associated with this condition. Finally, some research has shown a relationship between depression indices and incontinence (Ref. 105).

An implanted mechanical/hydraulic urinary continence device can restore continence and may improve quality of life. Published studies indicate a moderately high success rate for either restoring or improving continence. Some of these studies have also noted that the restoration of continence can improve quality of life (Refs. 20 and 38) and self-esteem (Ref. 26).

G. Need for Information for Risk/Benefits Assessment of the Device

As the above sections indicate, there is reasonable identification of the risks and benefits associated with the implanted mechanical/hydraulic urinary continence device. There is, however, insufficient valid scientific evidence to permit FDA to perform a risk/benefit analysis. Therefore, FDA is now seeking further information on the following safety and effectiveness issues associated with the implanted mechanical/hydraulic urinary continence device: