Imaging of Urethral Bulking Agents

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Learning Objectives

1. To discuss two-dimensional (2D)/three-dimensional (3D) transperineal and 3D endovaginal ultrasound imaging techniques in the investigation of the UBAs
2. To explore clinical applications of sonographic imaging of the UBAs

Introduction

Injection of urethral bulking agents (UBAs) has gained wide popularity, with documented effectiveness and safe side-effect profile in the management of stress urinary incontinence (SUI).

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The procedure has been proved to be a viable alternative to surgery in patients with persistent or recurrent stress urinary incontinence (SUI) due to intrinsic sphincter deficiency [1]. The UBAs are materials that can be implanted into the walls of the urethra, either transurethrally or periurethrally, to improve urethral coaptation during the storage phase of the micturition cycle, while allowing normal urinary stream during the voiding phase [2]. It has several advantages: it is a minimally invasive procedure performed under local anesthesia and is amenable to office therapy [3].

Injection of UBAs to cause periurethral scarring and closure of the urethra with sodium morrhuate was first described in the 1930s [4]. However, it is in the last decade that UBAs have gained major currency with many agents being used for treating female SUI. The commonly used agents include Coaptite (BioForm Medical, San Mateo, CA, USA) and Macroplastique (MPQ) (Uroplasty, Minnetonka, MN, USA). Coaptite consists of calcium hydroxylapatite (CaHA) in a gel carrier [5], whereas MPQ is a polydimethylsiloxane (solid silicone elastomer) implants suspended in an inert, excretable water-soluble hydrogel [6]. The newer synthetic UBA such as MPQ or Coaptite have longer durability and improve upon early injection treatment options like collagen, autologous fat, and polytetrafluoroethylene, which were also associated with problems of resorption, allergic reaction or hypersensitivity, and migration [6]. However, success rates are highly variable [7] and mechanism of action is not entirely known.

Three-dimensional (3D) ultrasound imaging is an objective tool for the assessment of the lower urinary tract and pelvic floor. Coaptite and MPQ can be clearly visualized on 3D endovaginal ultrasound (3D EVUS), and therefore ultrasound imaging may be useful in improving treatment outcomes [1]. This new technique allows for more accurate and precise volume estimation than the conventional B-mode imaging [8]. It allows visualization of bulking materials in planes that cannot be assessed by conventional imaging techniques [9]. In addition, multicompartmental 3D imaging helps obtain detailed anatomical examination with a combination of transducers: perineal scan with the abdominal wide array probe, endovaginal 180° scan with the BK 8848 probe and 360° scan with the BK 2052/8838 probe (BK Ultrasound, Analogic, Peabody, MA, USA). By manipulating the obtained 3D volumes using a combination of oblique and straight planes and rendered volumes, we can differentiate artifacts and obtain an accurate and comprehensive picture of the periurethral distribution of the UBA.

This chapter will delineate in detail the use of multicompartmental ultrasound imaging in patients who have undergone UBA injection for the treatment of SUI. It will describe both endovaginal and perineal imaging to provide a comprehensive review about its use in the imaging of UBA.

Potential of Multicompartmental Ultrasound Imaging in the Visualization of Periurethral Distribution of Bulking Agents: Why Bother?

Though UBAs have become a part of the regular armamentarium of the urogynecologist and female urologist, there are many unresolved issues associated with the procedure that may account for the variable success rates reported in literature. A review of eight long-term trials ($N = 507$) showed that cure rates at 12 months post-treatment ranged between 20 and 71% with improvement rates between 19 and 48% [6, 10–16].

With follow-up extending up to 60 months, cure rates reported have ranged from 18 to 40%, and improvement rates have ranged between 33 and 39%, with repeated injections required to maintain efficacy [14, 16].

There are many plausible explanations for the variable outcomes [1]. There remains no universally accepted or standardized injection method [17]. The optimal volume of material for injection during a single session, the ideal site orientation for the injection, and the optimal number of reinjection sessions for any given agent (until clinical "failure" has been determined) have not been defined [18]. Transurethral injections are performed under cystoscopic control, as it enables the bolus to be visualized and injection to be continued until adequate mucosal coaptation is achieved [19]. However, published data suggest that endoscopically confirmed coaptation does not necessarily correlate with long-term improvement in continence [20]. More crucially, the ideal injection site has yet to be determined [19]. Reported injection locations have included from the level of the midurethra all the way to the bladder neck [19], however there is no clear evidence validating any one site [19]. The decision to perform repeat injections is also largely empirical and is generally based on patient reporting on the post-procedure impact on continence [1, 21]. Thus, identifying the optimal site of injection and other intraoperative clinical parameters that can reliably predict outcomes following the injection is highly desirable and may improve the cost-effectiveness of the procedure [1]. Multicompartmental 3D imaging may help achieve both goals given the inherent advantages of the technique detailed above.

Technical Details of Performing 3D EVUS to Visualize Urethral Bulking Agents

Offices specializing in pelvic floor disorders may have specialty 360° field-of-view three-dimensional endovaginal transducers. The only companies currently manufacturing such transducers are BK Ultrasound and Hitochi Aloka Medical (Mitaka, Japan). These transducers are

high frequency, and some are biplane probes obtaining images with both linear and perpendicular arrays, while others are 360° field-of-view probes that obtain the images axially. UBAs can be seen clearly with both.

The technique of performing multicompartmental 3D EVUS with the 8848, 8838 and the 2052 transducers of the BK Ultrasound line is explained in Chap. 2. All the important details regarding the technique as it pertains to imaging of slings are applicable to the imaging of UBA [9]. It is necessary to image the urethra in its entirety from the urethrovesical junction (UVJ) until the external urethral meatus and also include a portion of the bladder in the image obtained so that the distribution of the UBA can be viewed in its entirety. It may be useful sometimes to obtain two different volumes, one concentrating on the bladder and proximal part of the urethra, and the second on the caudad part of the urethra, to enable complete visualization of the UBA distribution. Increasing the depth may help to include the entire extent needed in a single volume, but it must be remembered that increasing the depth reduces the resolution and decreases the image size [9]. It is important to orient oneself to the egocentric coordinates of the volume obtained, for example to determine which surface of the 3D volume obtained with the 8848 transducer denotes the left of the patient and which one the right [9] to ensure that we accurately understand the periurethral distribution of the UBA (see Fig. 11.1).

Similarly, manipulation of the 3D volume obtained with transducers such as the 2052 and the 8838 probes of the BK Ultrasound line of machines can also be done in the axial, sagittal, and coronal planes (see Fig. 11.2). Manipulation of the 3D volume in the sagittal plane helps to ascertain the exact location of the UBA in relation to the urethral length, while manipulation in the axial plane gives valuable information about the periurethral distribution of the UBA.

The ultrasound signal produced by the UBAs varies, depending on the makeup of the agent. Collagen-based UBAs vary between hypoechoic, isoechoic, and hyperechoic [22] in echodensity, whereas the signal from a calcium-based agent will produce a hyperechoic structure on the image
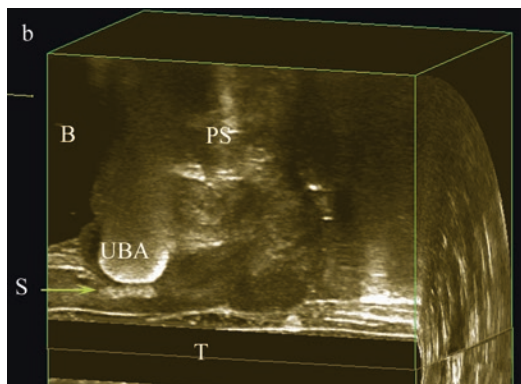

Fig. 11.1 3D 180°anterior compartment scan with the BK 8848 transducer: In sagittal view, the urethral bulking agent can be seen around the proximal urethra overlying a sling. This is a common finding in patients who have a non-functional sling in place. Transducer (*T*), bladder (*B*), urethral bulking agent (*UBA*), urethra (*U*), pubic symphysis (*PS*), sling (*S*)

(see Fig. 11.1). Bulking deposits vary in size and shape and also vary in their symmetry of periurethral distribution. Because of the irregular and varying shape UBAs take after injection; three-dimensional ultrasound is ideal for imaging as opposed to a purely cross-sectional modality [22].

While superior images can be obtained with specialty transducers, UBAs can be imaged well with transducers commonly found in most ultrasound departments. It is reasonable to assume that a sonographer may inadvertently stumble upon urethral bulking during a pelvic or renal sonogram. While the bladder is seen on both transabdominal pelvic and renal sonograms, the urethra is not routinely imaged on either study. UBAs can mimic a bladder stone when imaged transabdominally with a convex transducer (Fig. 11.3). If a questionable echogenic structure is seen transabdominally, additional imaging may be ordered. Given that ultrasound is the method of choice for imaging UBAs, a few questions about the patient's past medical history and few additional sonogram images may spare the patient the expense, inconvenience, and anxiety of additional imaging with another modality.

Apart from pelvic floor specialists, few sonographers may have heard of UBAs or procedures. If sonographers are knowledgeable about UBAs and the images they produce, we have the tools
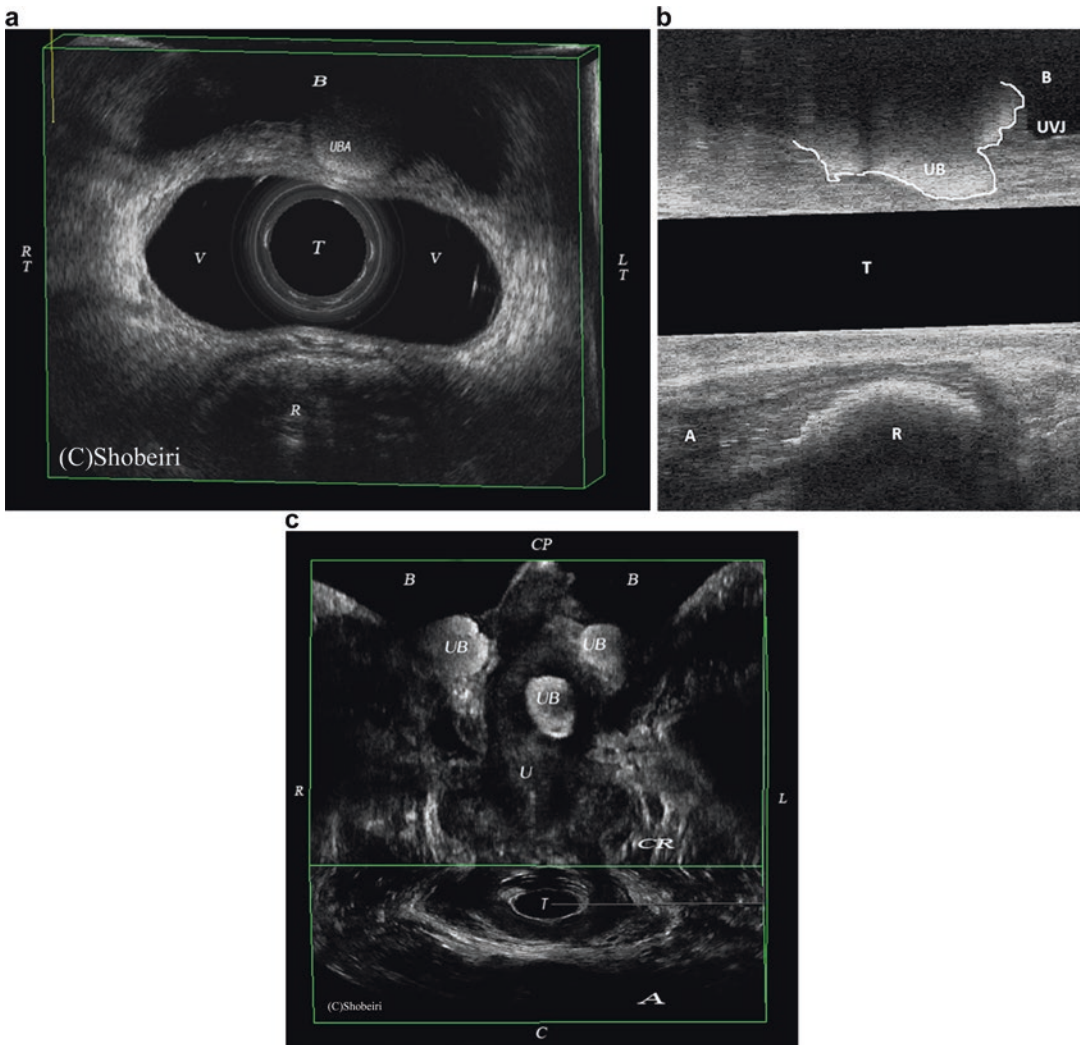
Fig. 11.2 (**a**) 360° scan. Urethral bulking instillation in the axial plane. Bladder (*B*), vagina (*V*), rectum (*R*), urethral bulking agent (*UBA*), right (*RT*), left (*LT*). Copyright Shobeiri. (**b**) 360° scan. Midurethral location of the urethral bulking (*UB*) agent marked out in the sagittal plane. Note the urethrovesical junction (*UVJ*) to the right of the picture. Transducer (*T*), rectum (*R*), anal canal (*A*), bladder (*B*). (**c**) 360°scan. Three urethral bulking (*UB*) balls seen in the coronal plane (*CP*) in the intended locations. Bladder (*B*), transducer (*T*), axial plane (*A*), caudad (*C*), coronal plane (*CR*), urethra (*U*), right (*R*), left (*L*). Copyright Shobeiri

available to help avoid unnecessary expense and CT radiation exposure to the patient. The same curved transducer used for transabdominal pelvic and renal sonograms can be used perineally to image the urethra. The patient should be scanned in the lithotomy position as when scanning transvaginally. The transducer should be prepped in a similar fashion as a traditional endovaginal transducer. An ample amount of gel should be dispensed on the transducer and then covered with a transducer cover or glove. It is important to ensure that there are no air pockets between the cover and the transducer. After applying gel on top of the cover, the transducer should be placed on the perineum. While tissue contact is required, care should be taken to avoid applying too much pressure [23]. The pubic symphysis, urethra, vagina, and rectum can all been seen clearly.
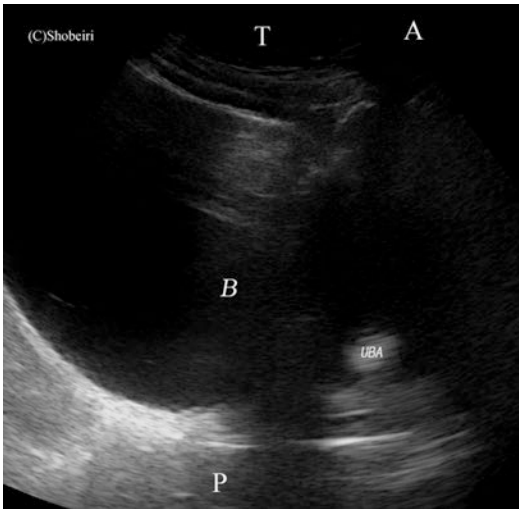
Fig. 11.3 Abdominal scan with a convex transducer (*T*) showing urethral bulking agent (*UBA*). Bladder (*B*), anterior (*A*) posterior (*P*). Copyright Shobeiri
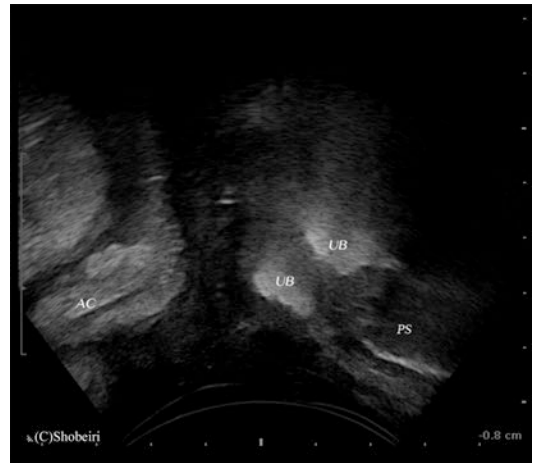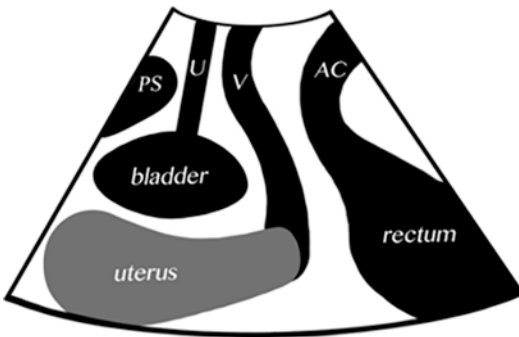

Fig. 11.5 2D perineal scan in the sagittal plane showing orientation preferred by pelvic floor imaging experts. Pubic symphysis (*PS*), urethral bulking (*UB*), anal canal (*AC*) Copyright Shobeiri

Fig. 11.4 Diagram showing how the perineal pelvic floor image is displayed when obtained using an abdominal probe. Pubic symphysis (*PS*), urethra (*U*), vagina (*V*), anal canal (*AC*). (With permission from Denson and Shobeiri [24])
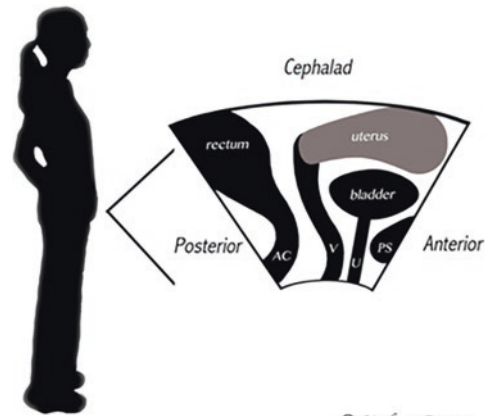
Fig. 11.6 Diagram representing the female pelvis in functional standing position. Pubic symphysis (*PS*), vagina (*V*), urethra (*U*), anal canal (*AC*). (With permission from Denson and Shobeiri [24])

The abdominal probes used for perineal pelvic floor imaging display the image on the screen as designed for an abdominal probe (Fig. 11.4) [24], not the anatomically correct orientation for pelvic floor imaging. Most experts in pelvic floor imaging prefer that the perineal image be displayed in a nontraditional orientation mainly because the preset on the ultrasound machines are meant to image the abdominal wall. The pelvic floor ultrasound image obtained by a wide array abdominal probe is therefore inverted and reversed (Fig. 11.5), as if the patient is standing, and the images are obtained from the left sagittal plane. We take the trouble of righting the image to the anatomically correct position. This orientation represents the female pelvis in the functional standing position (Fig. 11.6). This is considered our standard orientation in pelvic floor ultrasound imaging.
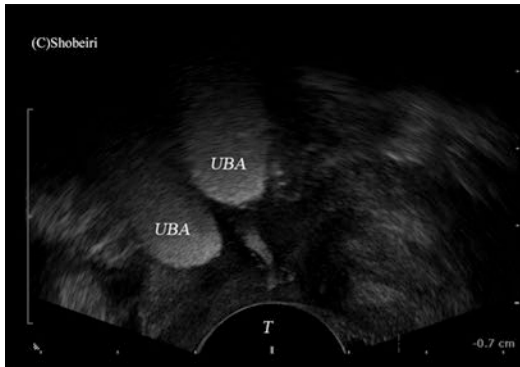
Fig. 11.7 Image obtained with end-firing vaginal probe. Pubic symphysis (*PS*), transducer (*T*), urethral bulking agent (*UBA*) Copyright Shobeiri

End-firing vaginal probes typically used to image the uterus and ovaries can also be used to image the urethra and the bladder neck. Unfortunately, the urethra is typically bypassed completely as the pelvic organs are imaged. The transducer and patient should be prepped as usual for traditional endovaginal sonogram. On insertion, the transducer should be angled anteriorly to clearly view the urethra and UBA (Fig. 11.7).

Ultrasonographic Parameters of Bulking Agent Injection

Regardless of the ultrasound machine or probes used for imaging, the basic parameters needing to be determined are the location of the UBA injection in relation to the urethral length and the periurethral distribution.

Ideal Site of Injection

The position of the injected material may be more important than its quantity for good bulking effect [25, 26]. It has been suggested that bulking materials should be placed around the proximal urethra just distal to the urethrovesical junction. This is because only proximal placement of the material can help achieve two of the mechanisms of continence attributed to UBAs: cephalad augmentation of the urethral length, thereby enabling increased abdominal pressure transmission in the first quarter of the urethra, and prevention of bladder neck

opening during stress [27]. This is corroborated by a study [1] to identify sonographic parameters that are associated with successful outcomes following UBA injection. 360° 3D EVUS was performed in 100 treatment naïve patients following MPQ injection, and the location, volumes, periurethral distribution, and distance of the hyperechoic densities from the UVJ were assessed. The distance of the injected MPQ from the UVJ was determined by calculating the mean of the distance of the proximal limit of the left and right injected volumes from the UVJ (see Fig. 11.2b). For assessment of location of the injected MPQ, the urethra was divided along its length into three equal sections in the sagittal plane: proximal, middle, and distal [1]. The site of injection was considered to be proximal urethra, mid-urethra, or both if more than 50% of the area of either or both was filled with MPQ instillation (see Fig. 11.2b). The patients were divided into two groups: group A (72 patients) who had good clinical outcomes and group B (28 patients) who were not improved or worsened following the injection. Group A had a greater proportion of women with MPQ located around proximal urethra, while mid-urethral location was found to be significantly more frequent in group B ($P = 0.036$). The amount of MPQ injected in the two groups was, however, similar.

In a study of 23 women in which perineal ultrasound was carried out before and after periurethral collagen injection, it was reported that short-term continence status was related to the height of the "collagen bumps" on either side of the bladder neck [26]. Continence was not achieved in the study if the "bumps" were located less than 10 mm from the bladder neck [26]. In another study of 31 women, in whom perineal ultrasound was performed 3 months after the first periurethral collagen implant, a distance of collagen from the bladder neck of less than 7 mm was found to be associated with positive outcomes. The threshold of 7 mm was found to have a sensitivity of 83.3%, specificity of 85.7%, positive predictive value of 93.7%, and negative predictive value of 66.6% [28].

Although these studies support instillation of the material in the proximal urethra, description of the implants only in terms of the distance from the UVJ may not be adequate, as it does not take

into account the extent to which the proximal urethra is filled with the implant [1]. For example, the implant may be only 3 mm in distance from the urethrovesical junction; however, it may only fill 10% of the proximal urethra and the rest of the implant may be placed mostly in the midurethra [1]. Significantly, in the study by the first author of this chapter, we did not find any statistically significant difference in the distance of the MPQ implants from the UVJ between groups [1].

Periurethral Distribution of MPQ

In our study the periurethral distribution of the UBA injection was also studied by manipulating the 3D data volume to determine the axial plane in which the instillation of MPQ was maximal. The area of each quadrant filled with MPQ was determined in the selected axial plane [1]. Each quadrant was considered to be adequately filled if more than 50% of the area of the quadrant in the selected axial plane was filled with MPQ. The 3D data volume for each patient was then assessed to determine the number of quadrants adequately filled with MPQ: If more than 50% of the area of 3 consecutive quadrants or all 4 quadrants were filled with MPQ, the patient was considered to have "circumferential" distribution. If less than 50% of the area of three consecutive quadrants or only 2 or 1 quadrant were filled with MPQ, the patient was considered to have "partial" distribution (see Figs. 11.8 and 11.9). The odds of a circumferential periurethral distribution in group A were found to be 13.62 times that in group B (95% CI: 5.12–56.95; $P < 0.001$).

Other studies have also commented on periurethral distribution of UBAs and its correlation with clinical success. In a retrospective study of 46 women in whom 3D perineal ultrasound was performed 4 to 12 weeks following the periurethral collagen injection, Defreitas et al. [21] found that a significantly greater proportion of women with a good clinical outcome had circumferentially distributed collagen on ultrasound (62%) compared with the women who did not benefit from the treatment (20%, $P = 0.006$). Conversely, a significantly greater proportion of women who did not benefit from the treatment had a partial

distribution (68%) compared with the women with a good clinical outcome (29%; $P = 0.0169$). Radley et al. [12] performed transurethral 3D ultrasound in 9 patients after MPQ injection. They reported that in the 6 women with good outcome, echogenic MPQ foci were seen to almost completely encircle the urethra, whereas in the 3 women with persistent stress incontinence, urethral encirclement was incomplete and large gaps were observed between echogenic areas [12]. However, in these two studies, the criteria used to define distributions were not based on actual area measurements that are replicable [1]. In the paper by Defreitas et al., the term "asymmetric" was used to describe an ultrasound finding in which collagen was located in predominantly one area around the urethra, either right, left, anterior, or posterior [21]. Equal distribution of the collagen between the left and right sides of the urethra was termed "symmetric" and "circumferential" was used when the collagen was distributed in a circular or horseshoe configuration [1, 21]. Our study provides standard criteria based on area cut-offs to define circumferential and partial distribution that can be reliably reproduced and used in both further studies and in practice [1]. Poon et al. [29] reported that on ultrasound the volume of the injected material at which continence improvement was achieved following collagen injection spanned a fairly broad range, from 1 cm³ to more than 5 cm³. Thus, they argued that more than measuring the volume of the implant, 3D ultrasound assessment is necessary to determine how well the periurethral submucosal space is circumferentially "filled" in a given patient. Our study corroborates this fact: it was the distribution of injected material in the various quadrants considered together that was found to correlate with clinical outcomes [1]. Volume measurements were not helpful, as the same volume of injected material can often occupy two quadrants in one patient and three in another [1].

Determination of periurethral distribution on 3D EUS following UBA injection has several potential benefits [1]. Our study suggests that circumferential periurethral distribution on ultrasound can be used as an intra-procedural parameter to predict short-term clinical outcomes [1]. In a patient with partial distribution seen on
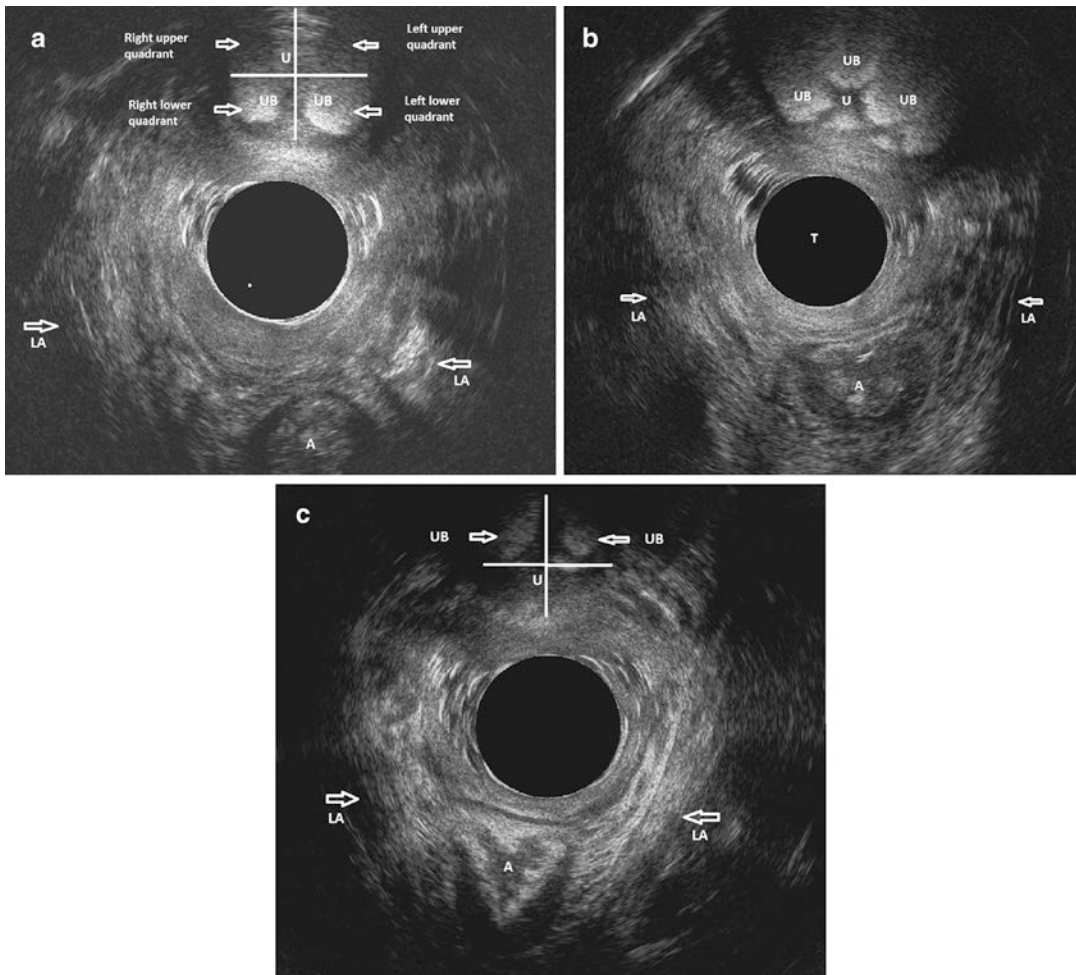
Fig. 11.8 (**a**) 360° scan. Measuring the periurethral distribution of urethral bulking (*UB*) agent instillation in the axial plane. Anal canal (*A*), levator ani muscles (*LA*), urethra (*U*). (**b**) 360° scan. Circumferentially distributed urethral bulking (*UB*) agent in the axial plane. Transducer (*T*), levator ani muscles (*LA*), urethra (*U*), anal canal (*A*). (**c**) 360° scan. Partially distributed urethral bulking (*UB*) agent in the axial plane. Levator ani muscles (*LA*), anal canal (*A*), urethra (*U*)

ultrasound performed immediately after the injection, UBA may be injected in an unfilled quadrant submucosally in the same visit so that circumferential distribution is obtained. Hence repeat injections can be avoided or the number of repeat injections needed may be reduced, thus reducing patient bother and also the cumulative costs of the procedure [1]. An ultrasound examination can also be performed during the follow-up visit in a patient with unsatisfactory improvement [1]. The need for a repeat injection can be determined, and the quadrants where the material needs to be injected could be mapped out. An ultrasound can be performed immediately

after the repeat procedure to confirm the improved periurethral distribution of the UBA [1].

Though this seems plausible, it needs to be studied. It is necessary to perform ultrasound studies immediately after injection to determine whether the UBA stays where it is injected or traverses a path within the urethra over which the injecting doctor has no control. Another interesting study pursuant to this study would have been to follow up the patients in group B with repeat injections to convert the partial distribution into circumferential distribution to determine if that improved outcomes. DeFreitas et al. had performed repeat collagen injections in seven of their 27 patients
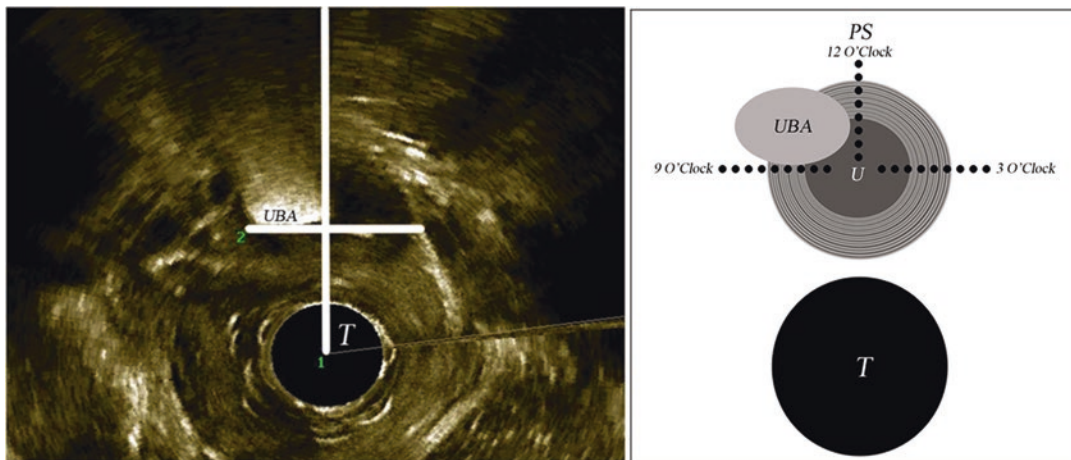
Fig. 11.9 (**a**) 360° scan in rendered view. Urethral bulking agent (*UBA*) seen in the axial plane. The urethra is identified and a vertical line toward pubic symphysis has been drawn as a marker for 12 o'clock position (*green 1*). A *horizontal line* has also been drawn from 3 o'clock (*green 2*) to 9 o'clock. The periurethral quadrant in which the UBA is located can be determined. Transducer (*T*), urethral bulking agent (*UBA*). (**b**) Diagrammatic representation of (**a**). Transducer (*T*), urethral bulking agent (*UBA*), urethra (*U*), pubic symphysis (*PS*)

who failed to improve after their first collagen treatment and converted them from an asymmetric to a circumferential distribution. Of these seven women, six had a good clinical response [21].

Shobeiri et al. [30] conducted a retrospective study in which they performed 3D EVUS after UBA injection done by three senior physicians who have performed more than 300 urethral bulking procedures. Per protocol, 1 cm^3 of the bulking material was injected at the 3 and 9 o'clock position, and if coaptation was not achieved, an additional 1 cm^3 was injected at the 6 o'clock position (see Fig. 11.9). The location, periurethral distribution, and distance of UBA from the UVJ, as well as the length of the urethra were assessed. The location of the UBA from the vesicourethral junction was reported as percentile of the urethral length. The periurethral distribution, location, length of the hyperechoic densities, and the distance of the injected material from the UVJ were assessed.

Out of the 22 patients studied, 18 (82%) subjects showed two sites of UBAs. The average location of the left and right implants were at 3.3 (range 1–12) and 8.8 (range 7–12) mm from the UVJ. The left implants were in 17% (±14%, 6.2 mm, range 0.5–17 mm) of the length of the urethra, while the right was at 26% (±21%, 8.9 mm, range 0–24.8 mm) of the length of the urethra
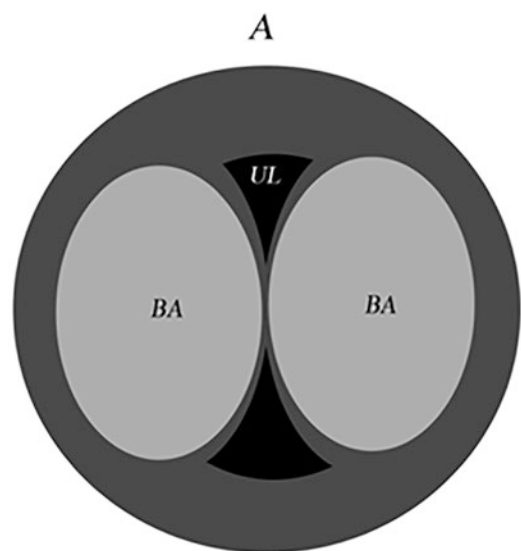

Fig. 11.10 Diagram showing injection of the bulking agent at 3 and 9 o'clock positions. Anterior (*A*), bulking agent (*BA*), urethral lumen (*UL*). (With permission from Denson and Shobeiri [24])

(Fig. 11.10). Eleven of 22 subjects (50%) had both sides within upper one third of the urethra. The difference in distance between the two sides was less than 10 mm in 12/22 (54%) patients. Nine of 22 (41%) patients had significant tracking of the material within the tissue rather than spherical configuration (Figs. 11.11 and 11.12).
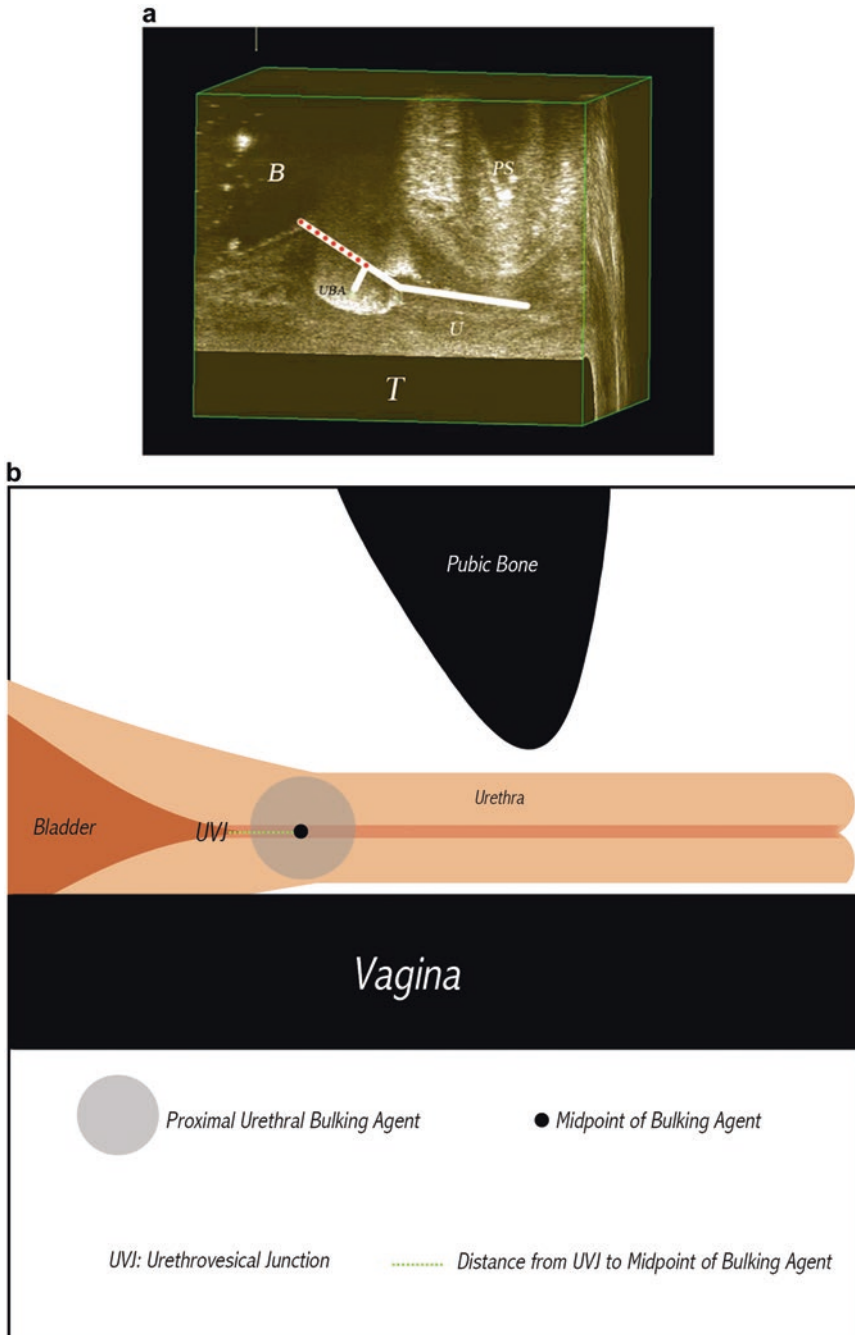
Fig. 11.11 (**a**) 3D 180° scan of the anterior pelvic compartment. The entire length of urethra was measured in the mid-sagittal view. A line was drawn from the center of the hyperechoic urethral bulking agent (*UBA*) to the urethra (*U*) in the shortest distance. The distance from the urethrovesical junction to this point was measured (*red dots*). This value was divided by the urethral length to obtain location of the bulking agent in terms of percentile of the urethral length. Bladder (*B*), transducer (*T*), urethra (*U*), pubic symphysis (*PS*). (**b**) Diagram showing measurement of the location of the bulking agent in relation to the urethral length. Urethrovesical junction (*UVJ*)
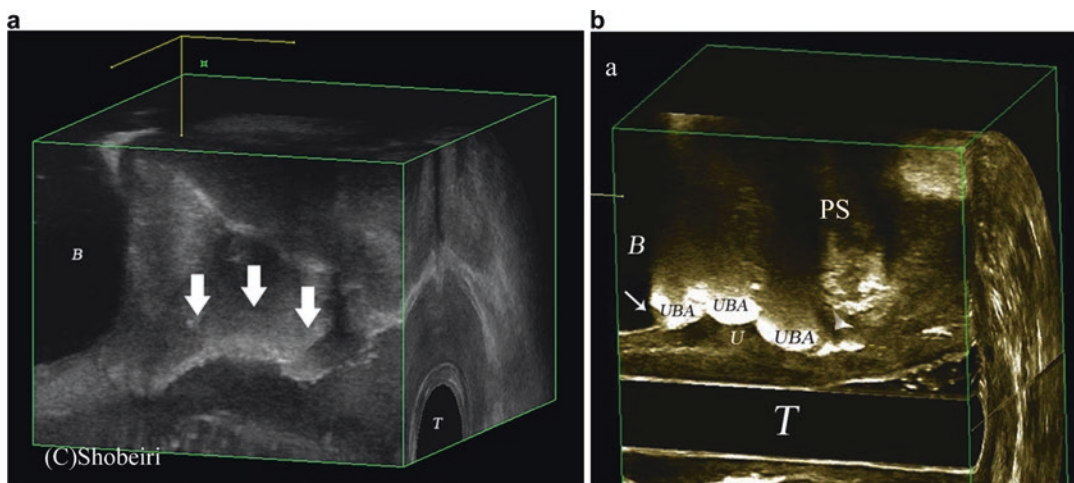
Fig. 11.12 (**a**) 3D 180° scan of the anterior pelvic compartment in the sagittal plane: Tracking of the bulking agent (*BA*) from proximal to distal urethra. Bladder (*B*), transducer (*T*). (**b**) 3D 180° scan of the anterior pelvic compartment in the sagittal plane. Tracking of the urethral bulking agent (*UBA*) seen. The UBA can be seen extending from proximal to distal urethra (*U*). Bladder (*B*), transducer (*T*), pubic symphysis (*PS*)

The authors interpreted the results to mean that while there is normal placement at the 3 and 6 o'clock position, the material is frequently not in the same place along the length of the urethra. Additionally, the 41% of material that tracks within the tissue does not contribute to urethral coaptation. They concluded that the UVAs are frequently not in the location that the operator intends them to be. In addition, the tracking of the material contributes to poor coaptation.

Though this study may seem to contradict the findings of our and other mentioned studies, it is important to state that the conclusions are based on a sample size of only 22 patients. Secondly, they did not correlate their findings with outcomes to determine whether—despite the fact that 41% of the material tracks within the urethral tissue and does not contribute to coaptation—in the patients in whom the material is still circumferentially distributed, the outcomes were better. Also, precisely because the material does not stay where it is injected, it indirectly supports the contention that ultrasound should be done following the injection to determine the symmetry of the material around the urethra and its location so that repeat injection can be performed in the injection—"naïve" quadrant.

Location of the Injection Plus Periurethral Distribution

In another study, when the location of the injection and the type of periurethral distribution were considered together, it was found that when the site of injection was proximal, the odds for circumferential distribution in group A were significantly greater than that in group B (odds ratio [95% C]): 22 [3.05–203], $P < 0.001$). Thus proximally located MPQ and circumferential periurethral distribution of MPQ are individually associated with successful outcomes following the injection. The study concluded that the combination of circumferentially distributed and proximally located MPQ is associated with best short-term clinical outcomes [1].

In centers with access to 3D EVUS examination, circumferential distribution of the injection can be ensured, in addition to confirming that the MPQ has been injected in a proximal location. Also multicompartmental scanning can be done; namely, 180° anterior pelvic compartment scanning can be performed with the 8848 probe [1] to confirm the findings of the 360° scan (Fig. 11.13).
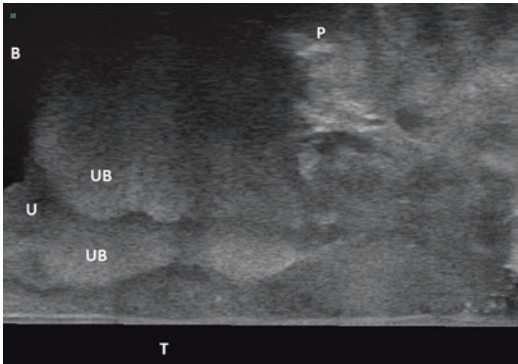
Fig. 11.13 180° scan of the anterior compartment. Urethral bulking (*UB*) agent circumferentially distributed around proximal urethra as seen in the sagittal plane. Bladder (*B*), urethra (*U*), transducer (*T*), pubic symphysis (*P*)

Conclusion

Though urethral bulking injection is an important part of the cornucopia of treatments offered for SUI, the outcomes are still variable. This is partially due to lack of control over periurethral distribution and location of the injected material even if utmost care is taken during injection. In such a situation, imaging modalities can have a significant role to play, in not just understanding how to optimize the procedure but also to determine the parameters that can ensure best outcomes. However, this is a nascent field and more research is needed, including randomized controlled trials, to determine whether the use of ultrasound intra-procedure can have any significant impact on outcomes. This chapter was an attempt to collate the effort done until now using 3D imaging methodologies. In the absence of 3D imaging capabilities, a 2D endovaginal transducer can also be used to obtain meaningful images.

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